REPORT

OF THE

PROCEEDINGS

OF THE

THIRTEENTH ANNUAL BLISTER RUST CONFERENCE

HELD IN

Boston, Massachusetts, November 28-29, 1927.

R E P O R T

OF THE

P R O C E E D I N G S

OF THE

THIRTEENTH ANNUAL BLISTER RUST CONFERENCE

HELD IN

BOSTON, MASSACHUSETTS, November 28-29, 1927.

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PROGRAM

THIRTEENTH ANNUAL BLISTER RUST CONTROL CONFERENCE

16th Floor, U.S. CUSTOM HOUSE, BOSTON, MASS. - NOVEMBER 28th & 29th, 1927.

November 28th - 9:30 A.M.

Opening Address.....W. O. Filley

I. Feasibility of Skunk Currant Eradication.....C. C. Perry

II. Most Efficient Eradication Crew.....J. E. Riley

III. Survey of Cultivated Ribes in Rhode Island.....A. W. Hurford

IV. Is Re-Eradication of Ribes Necessary.....P. H. Merrill

Will Pine Owners Re-Eradicate.....S. V. Holden

V. Standardization of Checking Practices.....J. D. Kennedy

VI. Making Winter Work of Agents More Effective.....H. L. McIntyre

November 29th - 9:00 A.M.

VII. Experiment to Determine Value of Pre-Eradication and methods of Increasing Acreage Eradication Per Man

A. Standard Six Man Crew and Scout.....L. E. Newman

B. Two or Three Man Crew and Scout.....W. O. Frost

VIII. Ribes Ecology.....A. E. Fivaz

IX. Progress Report of Epidemiology Study.....L. H. Pennington

X. Informal Talks: Subjects and Speakers Will Be Announced at the Conference.

GENERAL DISCUSSION FOLLOWING EACH PAPER

Space will be Provided for Exhibit Material.

BLISTER RUST CONFERENCE, BOSTON, MASS.,

Opening Remarks by W. O. Filley.

* * * *

As it seems to rest with me to sound the keynote of this conference, I am going to emphasize two points. The first one is that this is an agent's conference and its success will depend on how fully you who are actively engaged in blister rust control work take part in the discussions. We have sometimes had men from other lines of work who brought us inspiration, but our program this time consists almost entirely of reports and papers bearing directly on our work, presented by men whom we know and with whom we can discuss them fully and frankly.

My second point is that we must keep in mind the obligation we are under to complete our program for establishing blister rust control by June 1930, so far as that is humanly possible. From now on we must take inventory often, and lay out the work with our goal in view. Of course, some provision will have to be made for maintaining control when established, but our first concern must be to keep faith with former Secretary Wallace of the U. S. Department of Agriculture who made possible our present organization, and with the state legislatures which have accepted our program and furnished the necessary funds to carry it out. The best argument for maintaining the control work under the present organization will be the completion of the preliminary program on time.

Since our last conference we have lost a friend and comrade who was an unfailing source of inspiration in our work. Superintendent of Forests Pettis of New York, who made the opening address at Albany last December, passed away soon after that meeting. We must not fail at this conference to pay him the tribute he deserves for his interest and belief in blister rust control. Not only was he the first forester in this country to fully recognize the menace to white pine, but also the first to accept the possibility of controlling the disease and to undertake the necessary steps to bring it about. He, as much as any one perhaps, convinced Secretary Wallace of the necessity for Federal cooperation with the States, and he was always ready to help in every crisis. His work is done, but the task he started remains for us to finish. May we face it with courage and determination as he did for nearly two decades.

PROGRESS OF BLISTER RUST CONTROL IN THE WEST

By S. B. Detwiler

Cultivated black currant eradication has been completed in Montana, Idaho, Washington and Oregon, and in approximately two-thirds of the State of California. At least two more field seasons will be necessary to complete this work in California. Some re-checking in all states may thereafter be necessary.

In the west, costs of Ribes eradication over any large area will vary from $1.25 to $2.50 per acre. The cost in Idaho for 1926 was $1.26 per acre on an area containing an average of 43 Ribes per acre. The cost in 1927, on an area of approximately the same degree of accessibility, but representing rather more difficult working conditions and containing an average of 122 Ribes per acre was $2.33 per acre. This is the largest number of Ribes yet encountered on any large area. On the Stanislaus National Forest, recognized by the Forest Service as lying within the optimum range of sugar pine, the cost of this work to date has varied between $2.00 and $2.50 per acre; this experimental work is, however, in its early stages and it is therefore expected that these costs will be decreased.

Chemical Eradication of Ribes

Experiments to determine the feasibility of chemical eradication have been under way for four seasons. A very small study was made at first but due to the success attained, the work was constantly increased in scope. We are now in a position to definitely state that R. petiolare Dougl. one of the three species of Ribes which frequently occur in great numbers in stream bottoms of the white-pine type and which is so susceptible to the blister rust that it will constitute a very serious menace to nearby pine stands, can be much more effectively and cheaply eradicated by means of chemicals than by hand pulling. The estimated saving of chemical eradication over hand pulling is at present 35% to 50%. Intensive investigational work now under way shows a probability that the present cost of chemical eradication can be materially decreased without the loss of killing-efficiency. We believe that further research and experiment will produce as good results with other species of Ribes growing in large concentrations as have been obtained with R. petiolare. With the headway which has been made on this particular line of experimental work the prospect is bright that the future standard method of eradicating Ribes in stream bottoms where they grow in great profusion will be by the application of chemicals rather than by slow, expensive, and relatively inefficient hand pulling. When this method is further developed it will materially decrease the average costs per acre which are now being secured by hand pulling. Up to the present time an unduly high proportion of the total cost of hand eradication has been tied up in the work in stream bottoms.

Studies of Ribes Ecology

Field studies in Ribes ecology to secure basic information of value to local control practices and to determine the feasibility of decreasing the Ribes flora of the white-pine type by means of forest management have been under way for four years. The results obtained during this period indicate that the studies can be made of major value to the development of local control practices and that there exists a real possibility of at least partially decreasing the Ribes flora of the forest by means of management. The high lights of the results thus far obtained (and further study is required before exact statements can be made) are as follows:

(a) Reasonably well stocked forest stands in the white pine type tend to free themselves from Ribes growth with increasing age. This may be due to increasing shade on the forest floor, to root competition, or some other factor not yet recognized. The results of this action, whatever the cause may be, is that the older bushes very gradually die out and none or very few young ones start.

(b) The data now available strongly indicate that Ribes seeds are not disseminated over long distances but that they may remain viable in the duff for long periods and will germinate when the proper conditions are set up. The significance of this is that if Ribes are uprooted from an area before seeding, it will mean a steadily decreasing number of seedlings until the ground becomes practically Ribes-free.

(c) Disturbances of the ecological conditions of a normal well-stocked forest are often immediately followed by a heavy growth of Ribes. Such a Ribes growth may be caused by mechanical disturbance of the duff as logging or road building, and by forest fire. In this connection, however, it should be pointed out that the severity of the forest fire is a factor of major importance in the subsequent development of the Ribes flora. In general, it can be stated that a fire which is so hot as to destroy the possibility of white pine reproduction for many years will also prevent the growth of Ribes.

Spread of the Rust

The 1927 growing season proved to be very favorable for the spread of white-pine blister rust. The white-pine stands of the Inland Empire have now been directly invaded, as proved by the finding of infection on Ribes 7 miles north of Priest River, Idaho, and numerous infections in northeastern Washington. The development and intensification of the rust in the coast region of Washington has reached such a point that from now on a large volume of aeciospores will be produced, favoring southward spread of rust on Ribes. Rust infection on Ribes was found in five northwestern counties of Oregon in 1927. This spread appears to be due to a heavy but unknown source of pine

infection in the general vicinity of Mt. St. Helens, Washington. A small pine infection center was found in 1927 at Spirit Lake, on the north slope of Mt. St. Helens. It is very likely that pine infection has been established in northwestern Oregon during the present season as a result of the extensive Ribes infection there.

Investigation of the Fungus

The Office of Forest Pathology reports that "for the first time the disease was found widely distributed on wild species of Ribes in British Columbia in the Dry Belt and Cariboo Districts, which lie between the white pine belts of the coast and interior. In previous years it had been possible to find it on the cultivated black currants only and in some years the distribution was very limited even on these. This year the range of the disease in this section extended south of the International Boundary and was traced northward to a point some thirty miles north of Prince George, 120 miles further than ever before. In the coastal region it was found to the north over 300 miles beyond the northern limits of western white pine there and 190 miles farther north than in any preceding season. Furthermore, its spread this year in this section included the Queen Charlotte Islands. The southern extremity of these is situated some 90 miles off shore from the mainland, a full 200 miles north and west of the northern limits of the coastal belt of western white pine. The northern end of the islands is about 45 miles off shore opposite Prince Rupert. No white pines are known to occur anywhere upon them. These islands were scouted for Ribes infections in 1923 with negative results. The appearance of the disease there this year and its spread on the mainland may be considered the final contribution to the overwhelming mass of circumstantial evidence in favor of long distance spread from pine to Ribes to account for exceedingly rapid distribution of the disease over its present range. From this season's data it is now evident that jumps from pines to Ribes may be expected in favorable seasons over distances of two or three hundred miles.

"From scouting south of the International Boundary two particularly interesting and important results have developed in connection with southward spread of the disease. First, the discovery of the disease on pines near Spirit Lake in the Cascade Mountains opposite the mouth of the Columbia River and later the finding of the disease on Ribes near Priest River, Idaho, well within the western limits of the main commercial range of western white pine. Considering the first of these in conjunction with this and previous seasons' evidence on the capacity of the rust for long distance spread, there seems to be little if any hope for considerable delay before the rust will appear in the range of sugar pine. The disease may in fact be there now. In the case of the second discovery we know now that the disease has spread into the main commercial stands of western white pine. It must be borne in mind that it will yet be some time before any general and heavy distribution may become evident but the disease may be expected to appear there on Ribes with increasing frequency and before long will no doubt be found on pines.

"Conditions for infection of the pines this year (1927) were apparently very favorable. There was a large production of the spores which transmit the disease from Ribes to nearby pines and during the period of this production moisture conditions were generally propitious for infection. Heavy

intensification of the disease on pines in already established centers and the establishment of numerous new pine infection centers are therefore expected to mark the progress of the disease for 1927.

"In connection with the long distance distribution of the disease since its inception here in the West it has been noted that the greatest seasonal spread has usually occurred to the north and east and that the progress of the rust to the southward has been relatively slower. On the basis of results at large in the present investigations, a new theory may now be advanced as another reasonably probable explanation for this, in addition to that based on direction and character of the winds. During investigations of Ribes susceptibility it has become evident that the leaves are generally most susceptible to infection by aeciospores at a considerably earlier stage of development than hitherto has been thought to be the case, and that for most species resistance to such infection develops very soon after, if not even shortly before, the leaves have attained full size. In 1926 spring was exceptionally early. Ribes developed their leaves far earlier than in previous seasons or in the present season. The time of spore production on the pines was much less materially affected. This placed Ribes leaf-development relatively much ahead of the period of maximum spore production. Moisture conditions were apparently ideal for infection. Yet infection was relatively light and spread was slight except at the higher elevations and to the north. To the north spread was wider than in any previous year. The virtual confinement of spread to a northward direction was explained on the basis that Ribes leaves at the lower elevations and to the south were generally too far advanced to accept infection readily from aeciospores by the time the main production of the latter commenced. This conclusion may be applied to southward spread in general. Even in a late season Ribes leaves, except at the higher elevations far to the south, may pass thru the period of maximum susceptibility before heavy spore production has commenced on pines to the north. On the other hand, since this production of spores continues for a considerable time there will always be plenty of them to cause infection as Ribes leaves are developing to the proper stage to the north."

In closing his talk relative to conditions in the West, Mr. Detwiler expressed his appreciation of the faith and loyalty of the agents toward their work and stressed particularly the spirit of interest and cooperation as evidenced thruout the conference. Whereas blister rust control started as a unit in itself, commendable progress has been made working to include blister rust as an integral and necessary part of forest management. Mr. Detwiler concluded by calling attention to the need for renewed energy in furthering the present program, in order that the task in hand will be faithfully completed by 1930.

RESULTS OF COOPERATIVE BLISTER RUST CONTROL WORK IN NEW ENGLAND AND NEW YORK DURING 1927.

By E. C. Filler

The 1927 eradication work was successful in spite of a late spring, excessive rains during the summer, and early defoliation of the bushes, caused principally by heavy infection. In New England and New York, a total of 893,642 acres were cleared of 7,812,142 wild Ribes and 48,738 cultivated bushes at a cost of $152,315.66, or 17.04 cents per acre. In comparing 1927 results with those of 1926, a substantial increase of 9.7 percent is noted in acreage examined for Ribes. This increase is due entirely to great increased acreages worked in Massachusetts, New York, and New Hampshire; decreases occurred in all other states. In spite of a greater acreage examined in 1927, 11.6 percent less Ribes were pulled, apparently because 11.3 percent of the acreage was re-eradicated area.

Town Cooperation

A total of 127 towns in Maine, New Hampshire, Vermont, and Connecticut expended $38,284.54 on eradicating Ribes. In Vermont and Maine, $8,360.21 of town funds were used to cooperate with individuals, while in New Hampshire $28,924.33 of town money was expended in working town areas irrespective of property lines. In Connecticut, a town appropriation of $500 and an additional $500 of town money, raised by individual subscription, was used with state funds for eradicating Ribes from definite town blocks. Compared with last year, 7.1 percent less town money was expended on control work. The cooperative projects in New Hampshire and Connecticut, where definite blocks were examined irrespective of property lines, resulted in 220,576 acres being cleared of Ribes during 1927. This acreage is 5.9 percent greater than last year, and represents 24.7 percent of the total area covered in the Northeast during 1927.

Individual Cooperation

In New England and New York, 4,426 individuals expended $48,991.06, in cooperation with the states, in clearing 291,611 acres of Ribes. In Massachusetts, New York, and New Hampshire, the figures for 1927 exceeded those of last year for the following items: number of individual cooperators, amount expended by individuals, and acreage worked. Decreases in number of cooperators and acreage examined are noted in the other states, except Rhode Island, where the control work is conducted by the state. The acreage worked in cooperation with individuals represents 32.6 percent of the total area examined in the Northeastern States during 1927. Comparing the totals of the individual cooperative work in all states during 1927 with the preceding year, increases occurred as follows: number cooperators- 10.0%; amount of money expended by individuals- 10.9%; and acreage examined - 20.6%.

State Scouting

Four states- Maine, Massachusetts, Connecticut and Rhode Island, scouted lands containing few Ribes. In Maine, 87.2% of the total acreage covered was worked on this basis; in Connecticut, 26.1%; in Massachusetts, 42.6%; and in Rhode Island, 100%. A total of 368,161 acres were scouted in these four states. This acreage represents 41.2% of the total area worked in the Northeast during 1927. This year, 6.4% more acreage was worked on this basis than during 1926; Massachusetts making a gain of 129.4%, while decreases occurred in Maine and Rhode Island of 13.4% and 65.4%, respectively. The large decrease in the latter state was due to the curtailing of the work in August, due to lack of funds.

State Land Projects

Ribes eradication work on state lands was performed in Massachusetts, New York, Connecticut, Vermont and New Hampshire. A total of 13,239 acres were covered. Most of this work was performed in Massachusetts and New York. The acreage eradicated of Ribes on state lands represents 1.5% of the total area worked in the Northeastern States during 1927. This year, 28.0% less acreage was worked on state lands than in 1926.

Re-eradication

Re-eradication was conducted in all the New England states, except Rhode Island, during 1927; 101,137 acres being reworked, or 11.3% of the total area examined for Ribes this season in the Northeastern States. In each state, a percentage of the total acreage examined was area previously worked, as follows: Massachusetts- 5.1%; Vermont- 12.0%; New Hampshire- 32.8%; Connecticut- 42.2%; and Maine 0.4%.

The Ribes eradication work is the direct result of successful educational and service activities. In order to appreciate more fully the status of these phases of our program, the following summaries of the permanent agents' work are given for the period January 1 to September 30.

Blister rust control has been making steady progress since the present program was initiated in June, 1922. Since that time, a total of 4,682,999 acres* in New England and New York have been cleared of 46,232,812** wild and 304,660 cultivated Ribes, at a per acre cost of 17.6 cents. In the application of control measures, 20,887 individual cooperators have spent $246,064.39. In addition, $225,722.38 has been expended from 710 town appropriations in four states. Several thousand additional persons have cooperated by destroying their cultivated bushes without compensation, or by aiding the control program in other ways.

Since the beginning of control work in 1917, a total of 61,959,842** wild and cultivated Ribes have been eradicated, in New England and New York, from 5,955,464 acres*; a section considerably larger than the entire land area of Rhode Island and Massachusetts.

* - Of this total area, 236,812 acres have been examined twice for Ribes.

**- These Ribes figures include all bushes found on the area, in both initial and re-eradication work.

Educational and Service Activities- Jan. 1-Sept. 30, 1927.

Educational Items		Total Number	Percent increase or decrease 1927 over 1926. (Permanent Agents)	Monthly number per average permanent agent 1927.
Meetings		403	+ 7.7	1.34
Attendance		30,617	+ 21.5	-
Field Demonstration Meetings		134	+ 0.8	.40
Attendance		2,402	-31.3	-
Fair and Window Demonstrations		583	+ 19.2	1.53
Publications		76,796	+ 15.1	249.03
News items		979	+ 11.9	3.27
Posters		5,822	-13.0	13.89
Service Items				Daily number per permanent agent
Initial Interviews		10,721	+ 14.3	1.14
Follow up calls		6,780	+ 20.2	0.85
Individual	Control Methods	44,900	+ 45.8	0.53
Instruction	disease	6,275	+ 14.3	0.69

STUDIES OF RIBES ECOLOGY

By A. E. Fivaz

Much of the blister rust investigative work done in the east has been centered on the effect of having Ribes in the pine stand. The primary value of these investigations of blister rust damage has been the use of the data in showing white pine owners why eradication of Ribes is a necessity of pine production.

On the other hand, comparatively little information has been sought concerning the effect of having a pine stand over the Ribes - or, more broadly, the effect of environment on Ribes. There is no doubt that this inverted view of the problem is the one we must have to make progress in studying and planning the permanent control of the blister rust.

This past summer, work was begun in New York State on a study of the number, size and condition of Ribes (largely R. rotundifolium Michx.) under all ages and densities of stands, and following all varieties of forest treatments. After a good volume of data has been obtained it is hoped that the cross sections of Ribes conditions in stands of all descriptions can be assembled to furnish a working knowledge of the life history of the important New York species, Ribes rotundifolium. This basic data should tell us (for New York conditions) where we must re-eradicate, when it must be done, and how we can use silvicultural means to best advantage in the natural control of Ribes.

This study involves a tremendous amount of field work. We have not the time (it would take ten years or more) to follow by repeated examinations the germination, growth and development of Ribes under all possible conditions of site and stand. Instead, we must examine the Ribes status of a large number of plots, obtain a cross-section of conditions and rely on high duplication of similar plots to reduce the errors of sampling and of interpretation. The almost innumerable combinations of habitat conditions which may influence Ribes, complicate the work. Plots have to be chosen very carefully, must be uniform throughout as to major factors at least, and must be examined with detailed care especially for the smaller bushes.

Fifty-odd plots totalling about 10 acres in area, was the crop of the first season's work with one data crew. Definite conclusions can be based on no less than five times this amount of data - and all this for one species. Although no conclusive results have been obtained, interesting preliminary indications have shown up.

One of these is the viability of Ribes seed, as stored by nature in duff and humus. Considerable evidence points out that this stored seed may retain its viability for many years, and that disturbance of the duff and stand as in logging sets up conditions favorable for its germination.

The influence of fire on Ribes was another interesting observation. The so-called Cunningham burn in Warrensburg originated in a freshly slashed pine plain and developed into a terrific crown fire in adjacent reproduction.

This took place in the spring of 1925 - and over many acres there was not a green thing left, not as much as a green blade of grass. Ribes sprouted from old crowns late in 1925, and were in some cases already producing fruit in 1927 slightly more than two years following the fire. Most interesting was the heavy germination of Ribes seedlings in 1926 and 1927. Evidently, the fire by clearing the cover, destroying the dry duff, and perhaps by improving the condition of the seeds themselves, had liberated for germination the stored supply of Ribes seed on this ground.

Experiments in the West have already indicated that oven-treated Ribes seed germinated where untreated seed failed- it is probable that light forest fires may be an important factor in increasing the germination per cent.

The summer's work brought out rather clearly the important relation between the history of the area and the Ribes population thereon. Indications point out that old cultivated fields regain a Ribes population very slowly, and that much of the gain results from the presence of permanent sources of Ribes seed in the immediate vicinity. A series of plots at Warrensburg, N.Y. consists of a twenty-foot-wide fence-row plot and three adjacent strip-plots of similar dimensions, extending into an old field from which the first crop of white pine has recently been clear cut. Ribes were found on the fence-row plot at the rate of 979 to the acre, of which the older bushes (over 10 years old) made up one quarter. The next adjacent plot, with its center twenty feet from the old fence-row, had Ribes at the rate of 360 to the acre, with old bushes making up 1/3; while on the next plot Ribes were 90 to the acre with 1/9th of these over 10 years old; and on the plot centering 60 feet from the fence row, Ribes were found at the rate of only 30 to the acre, with no bushes over 5 years old. On the other side of this fence on a more recently cultivated field just seeding up to pine in the last 15-20 years, only two Ribes were found, one near the boundary with the fence row plot, and the other underneath a couple of old pine trees around which an island of wild land had been left at time of recent cultivation. At the foot of this field is a small mud hole and an island of wild land was left out of cultivation there. This island of wild land was found to have Ribes at the rate of 279 to the acre. The importance of fence rows and wild land islands in restocking reverted fields with Ribes is rather clearly indicated by these data.

The available data indicates that Ribes come back in the forested parts of the old fields, rather than in the opening.

The means by which seeds are distributed into an old field furnish an interesting field for study, although perhaps one not especially profitable from the practical control standpoint. Evidently rodents, especially chipmunks, play a part as well as birds. There appears to be a gross exaggeration in ecological theories of these means of seed dispersal. Such theories fail to take into consideration the probability of seeds deposited years before, retaining their viability over a long period of years, and bridging by this means the wide gaps between the appearances of an individual species in a rapidly changing succession of plants.

There is good published evidence supporting the soundness of this theory. Published records of germination of seed of known ages include some which grew when over a hundred years old. The late Dr. Beal of Michigan Agricultural College secured germination of samples of ten of the twenty species of seed which he buried forty years previously. Mr. Goss of the Department's seed testing laboratory reports in a publication, the germination of samples of 51 out of 107 species of seed buried twenty years in soil at Arlington farm. Included among these was one member of the family Rosaceae to which Ribes belong, one of the Potentillas or cinquefoils, sometimes called hardhack. Several other works could be cited to strengthen this point.

To get back to seed dispersal, there is also a possibility that cattle and horses may deposit viable seed. Any observations bearing on Ribes ecology by men in the field should be reported immediately so that investigations can be made where the quickest results are promised.

In the past season's work there is some evidence that indicates that close grazing over a long period of time reduces Ribes. In a dry open pasture it is possible that all Ribes may disappear; whether directly as a result of grazing or of some other factor, it is not known. The fact that much the same Ribes decrease has been observed in dry non-grazed open sites indicates that the effect of some other factor is greater than that of grazing; perhaps it is lack of shade or moisture. Shade apparently has a big influence, whether direct or indirect, or whether just an indication of another factor such as root competition, on Ribes seeding, growth, and survival. Indications are that some shade is beneficial to germination and survival, but that heavy shade makes growth and even survival impossible, for Ribes rotundifolium.

The rather small volume of data available indicate the generalities of the Ribes curve for the Adirondack region, especially the rapid rise in number and live stem of bushes following logging; the natural elimination of these bushes soon after full-stocked stands reach their maximum densities, and the slow repopulation as the aging stands admit more light on the forest floor. For partially-stocked stands, the indicated curves of number of bushes and number feet of live stem have high peaks, reach them more rapidly, and have a strong tendency to remain high during the middle-ages of the stands.

Based on N.Y. Conditions - R. cynosbati L., R. rotundifolium Michx., R. triste Pall., R. lacustre (Pers.)Poir., R. prostratum L'Her. and R. hirtellum Michx.

I. Wild land (never cultivated or stumped)

A. New logging

1. Original stand full stocked

(a) Clear cut)
Selective cut) Eradicate before recovering bushes fruit
Heavy thin) (5 years after logging)

(b) Light thin (quality improv.) no eradication necessary)

2. Original stand partly stocked

(a) Clear cut) Eradicate one to two years after cutting to remove Selective cut) hazard bushes of size in original stand.

(x) Followed immediately by dense reproduction -No further eradication.

(y) Followed immediately by good reproduction -Re-eradicate 6 to 7 years after cut; no more thereafter.

(z) Followed by poor reproduction or slow -Re-eradicate 6 to 7 yrs. after cutting, and again 15 years after cutting, if stand not then closed.

B. Stands 10 to 20 years old

1. Full stocked - Eradicate immediately, - no further work needed.

2. Partially stocked - Eradicate immediately, re-eradicate every 7 or 8 years until canopy closed or pine 15 years from maturity (next cutting)

C. Stands 20 to 30 years old.

1. Full stocked - No eradication necessary.

2. Partially stocked - Eradicated immediately, especially in openings, re-eradicate once more after about 7 years if not then closed canopy - no further work thereafter unless for reproduction.

D. Stands 30-40 years old.

1. Full stocked - No eradication necessary.

2. Partially stocked

(a) Good advance reproduction - Eradicate immediately to protect reproduction and re-eradicate three years after cutting, then every 7 years until canopy closed.

(b) Slight or no advance reproduction - Eradicate just before logging, re-eradicate 5 years after logging and thereafter every 7 years until canopy closed.

E. Stand over 40 years old - Eradicate just before logging, re-eradicate five years after logging and thereafter every 7 years until canopy closed. If good advance reproduction, eradicate immediately regardless of logging.

II. Reverted land (once cultivated or stumped for intensive open pasturing)

A. First rotation since cultivated condition. - Eradicate stone walls, fence-rows, streamsides, roadsides, cellarholes, and all islands of wild land included in cultivated tract, immediately to prevent further seed production, and protect from damage, such young pine as is in vicinity of these hazardous locations. Recheck after seven years, these same places. No further work

for probably 20 years or until following first logging. Cultivated land itself will not need eradication, unless near cultivated red currant source (½ mile), and then only if considerable young reproduction and favorable Ribes site (moist).

B. Subsequent rotation from cultivated condition. - Follow same procedure as for wild lands (I) but spacing re-eradications farther apart, if warranted by number and location of bushes found first eradication.

Exceptions and Additions to (I) and (II).

A. Ledgy sites in heavy Ribes country. - Re-eradicate every 7 years until crop is 15 years from maturity and cutting.

B. Burns (ground fires only, crown fires are same as logging) - If stand is not closed, and not over 30 years old, re-eradicate 5 years after burn.

C. Windfall (spots only, large areas are same as logging). Eradicate windfall spots 5 years after occurrence to protect advance reproduction and reduce seeding.

D. Roadside, Walls, Fencerows, Cellarholes, etc. - Eradicate all such spots immediately to remove seed source and re-eradicate once after seven years.

E. Ribes prostratum beds. - Thorough job can be done where needed (open, young types) by re-eradication, the spring following year of eradication. If in a locality where skunk currant reproduces readily from seed, wait three or four years after first eradication to rework.

F. Protective strips. - It must be remembered that the nature of the pine being protected does not necessarily govern the treatment needed on protective borders. The type of stand on the protective strip as well as age of pine being protected, will govern eradication work done around the edge of the pine.

G. Estates and Parks not for timber production. - Since the pine in such areas has an indefinite length of time in which to be damaged by blister rust the Ribes population must be kept lower than on commercial pine areas. Re-eradication every seven years is warranted except in even-aged dense stands over 25 years of age.

H. Pastured pine areas. - Since the pasturing of timbered areas reduces the foliage (and probably root) competition of Ribes, and improves seeding conditions, such areas need more frequent attention than undisturbed wild lands. In such pastured types the dangerous Ribes are likely to be in protected places rather than in closely grazed openings.

I. Ribes seed sources. - Large sources of Ribes seed, of both wild and cultivated species, within ½ mile of pine-land are hazardous and should be eliminated.

J. Poor Ribes areas. - In regions where because of soil, moisture, or climatic conditions Ribes growth and distribution is poor, the frequency of reworking may be lessened, purposing not only to maintain the number and live stem volume of Ribes below that capable of causing commercial damage, but also to prevent any minor proportion of the bushes getting to seed-producing size.

The usefulness of such a schedule based on a greater volume of data will depend on the uniformity and size of the stand to which it is applied.

We must obtain by extensive research, a sound basis for predicting the changes in Ribes population and for planning to maturity and beyond, the safeguarding of white pine sites from the disease. With such a basis, it will be possible to outline for any individual pine lot, where and when eradication will be necessary and how it can be most economically accomplished.

Revision Dec. 15, 1927.

Discussion

Statements relating to the development of seedlings from seed buried in the duff, precipitated some considerable discussion.

Mr. Detwiler: Described experiments carried on in Idaho substantiating the evidence that seeds do remain in the duff and germinate under proper conditions.

Dr. York: Cited an experiment where several thousand Ribes seeds of different species, which were collected in 1917, and stored under ordinary room temperatures, were planted in 1927 and did not germinate.

Mr. Detwiler: Then referred to experiments conducted by Dr. Regan in Petersham, Mass., in which seeds were planted at different depths. This experiment showed that the only seedlings that developed were from the seed that was planted six inches under the ground.

Dr. York: Spoke further of greenhouse experiments which demonstrated quite a difference in germination in different species of Ribes.

Dr. Pennington: In support of Mr. Fivaz's contentions told of experiments at the Michigan Agricultural College, in which seeds that had been buried forty years were successfully germinated. This experiment is being continued at intervals of ten years to determine how long the power of germination may be retained in the seed.

Mr. Holden: Recalled the one-time practice of collecting all Ribes fruit during the eradication work. The fruit collected was buried and Mr. Holden commented that possibly some of these seeds may be upturned in years to come, and someone will be endeavoring to solve the mystery of their origin.

Mr. Fivaz: Made further comment to the effect that every wooded area has a certain degree of storage of seeds of all kinds including Ribes. The general occurrence is probably a provision of nature to perpetuate the species.

TWO OR THREE MAN CREW AND SCOUT

By W. O. Frost

"According to her cloth she cut
her coat" (Dryden)

This saying explains fully why Maine uses the two and three-man crew method. We cannot do otherwise even if we wished to; that is, if we expected to get anywhere with the available funds. We do not claim our method is the best method - neither do we criticize any other State's method, we merely cut our coat after our cloth, striving to make a B. V. D. look like an ulster. If we had more cloth our coat would be cut from a different pattern. We admit that much, but we firmly believe our policy the only one suited for the funds available.

From 1917 to 1921 six-men crews were used but a comparatively small acreage was protected. In 1922, when the present eight year program became effective, the Forest Commissioner and the State Leader spent considerable time lining up a control policy that would benefit the most pine owners in the southern half of the State during this period. We realized that every pine owner and taxpayer would not believe all we said, but we planned to give them the opportunity to help themselves -- whether they accepted it or not was up to them. There would be no "flareback" later on, no "Why didn't you tell us, etc."

Briefly, Maine's blister rust policy is "The State will cooperate with the U. S. Department of Agriculture, State Extension Service, towns, associations and individuals in control work. Control areas will be proclaimed within which all Ribes must be eradicated and their further growth or cultivation abandoned. The eradication of Ribes must be done by the pine owners or at their expense." Whether or not this policy is practicable must be determined from the figures presented in this paper.

The key to the whole situation is town appropriations, for it is only in towns making appropriations that control work is carried on. The towns' money is spent for the hire of a man called a town foreman. He assists the owner, who may furnish one or more men. Here is where the two and three-man crews enter, as it is only on rare occasions that small owners will furnish more than one or two men. The two-man crew consists of the town foreman and one man, usually the owner or his son. The three-man crew consists of the town foreman and two men furnished by the owner, usually the owner and a boy.

One of our county blister rust agents who had 389 cooperators this present season reports that 212 or 54% of them furnished a two-man crew, that 145 or 37% of them furnished three-man crews, that 30 or 8% furnished four-man crews, and but 2 jobs or 1% were worked by a five-man crew. Thus 91% of all eradication work is done by two and three-man crews. If this same percentage holds true, and we believe it does, we find that of the 1,372 eradication jobs performed this year, 1,249 were worked by two and

three-man crews. During the period 1922 to 1927 inclusive 7,765 pine owners have cooperated. Using the above percentage again we find that 7,066 of these jobs were done by two and three man-crews.

Why is this so, why cannot we use full sized crews? The answer is -- we haven't the "cloth", the funds do not allow it. The 53 towns appropriating this year raised $8,300, an average of about $156 per town. This amount would hire a six-man crew just about eight days. It is for this reason that we use the scout, town foreman, and owner's labor method, resulting in that we reach every pine owner in the town, everybody knows something about blister rust, if he doesn't, it's his own fault. In 1927 nearly 2,000 men, representing the towns and pine owners were taught blister rust control methods, actually performing eradication work. For the period 1923 to 1927 over 10,706 people representing the towns and pine owners have experienced Ribes eradication work, ninety percent of them working in two or three-man crews. This educational factor is a feature not to be belittled, in fact it is one of our strong points in obtaining town funds. By promising the pine owning tax-payer that we will show him how to control blister rust, that the State and government will scout and help him protect his lands, providing the town appropriates and he will furnish a man or two, usually results in a small town appropriation, followed by the two or three-man crew method work in 91% of the cases.

Using 1927 eradication season figures for a measuring stick we find that the average size job performed by 1,371 cooperators to be about 24 acres, although the greater part of them are much smaller. This small acreage per owner is due to intensive scouting, greatly favored by the fact that many of our jobs are following out runs, ravines, and small damp places where larger crews would be a hindrance.

The cost of all cooperative eradication work this year was 53 cents per acre, the cost ranging from under 20 cents to 97 cents per acre. This range is due to several things, such as ground cover, variety and quantity as well as size, of Ribes. As all acreage is estimated there is a chance to err on this figure but on the whole we believe these errors balance themselves in the long run.

The one great drawback with the two and three-man crew work is that green inexperienced men do the eradication. It would be but natural that the efficiency of such work would be lower than that of trained crews carried throughout the season. We admit we have some poor jobs, but on the whole we believe that the educational factor more than offsets a poor job now and then. We find that many owners go over their lots each year, bearing out our contention that the educational feature is a big factor.

The following checking figures presented by the county blister rust agents show the quality of work done by two and three-man crews.

TWO-MAN CREWS

Agent	No. Jobs	No. Checks	Efficiency range	Average per-cent of efficiency
Conner	212	201	90 - 98	97
Curtis	379	379	90 - 95	96
Kimball	115	109	87.3 - 96	87.4
White	140	36	78 - 93	86
Totals	846	725	78---98	92

THREE-MAN CREWS

Conner	145	166	91 - 98	97
Curtis	68	68	94 - 98	95
Kimball	128	124	86.5 - 96.4	93.5
White	6	6	83 - 88	86.
Totals	347	364	83 - 98	93

These figures show that good work can be done by small crews, the efficiency remaining about the same whether two or three men are used.

We oftentimes bewail our fate, in having to pursue such a policy -- it has many many disagreeable features we assure you, but by cutting our coat after our cloth we feel that there are several features most favorable to two and three-man crews.

Discussion:

Brief remarks by Messrs. Kennedy, Littlefield, Riley, and Newman relative to methods of reporting acreage eradicated.

WILL PINE OWNERS RE-ERADICATE?

By S. V. Holden

First I believe that most pine owners will re-eradicate if necessary. Second I believe it will be necessary in most cases in Vermont. I also believe it will be necessary to do considerable service work to get them to do so.

In Vermont I have seen very little good eradication work done when the pine owner eradicated at his own free will, and I do not believe they will re-eradicate unless some one calls to remind them of the necessity.

Pine owners are thinking for themselves in regard to pine production and blister rust control a great deal more now than they were when we started this clean-up program. Pine owners realize what the market is for the kind of pine they have at present.

Pine growers will hesitate to spend very much money per acre or act very anxious over pine protection until pine prices change for the better, therefore I think it quite necessary and important to carry on educational and service work to secure re-eradication and wait for prices of pine to advance sufficiently to interest and enthuse pine growers to fight for it.

When pine can be grown again st a good profit to the producer then we may expect the pine owner to take more interest in initial or re-eradication work.

Discussion:

Newman: Asks what attitude of pine owners is towards re-eradication.

Holden: Varies - certain classes of people willing to spend the money. If owners have something to protect, they do not hesitate to do it.

Kane: Owner asked him to look over lot in Littleton, N.H., which was worked in 1919. Found only 12 Ribes. Asks Holden if he mentions re-eradication when obtaining initial work.

Holden: Always tells owners as much about situation as possible, and mentions that re-eradication will be necessary in 5-8 years and that cost will be smaller than initial cost.

Conner: His experience bear out Holden's statement that pine owners will re-eradicate. One town in his district during 1927 raised funds for re-eradication voluntarily.

Perry: Asks if there is any difference in attitude of owners where large numbers of cultivated Ribes were removed.

Discussion (Cont'd)

Conner: No great number of such bushes taken out in any one place in his district.

Holden: No apparent effect in two towns in his district.

Hurford: In Rhode Island, people are educated to necessity of re-eradication.

White: Believes that re-eradication depends a good deal on educational programs carried on.

Newman: Under New Hampshire plan, re-eradication on part of town has come surprisingly easy.

Frost: Receive reports of small owners doing re-eradication. Large paper companies quite willing to do such work.

Swain: Found that one individual in his district had cut off bushes with knife. A little education would have helped in this case.

Perry: Have already stressed re-eradication. Tried out reminder card this year to learn number of cooperators doing re-eradication. In spite of the fact that they will re-eradicate, they will need some assistance. Follow-up work is necessary. About 50% of the cards returned.

SURVEY OF CULTIVATED RIBES IN RHODE ISLAND

By A. W. Hurford

Reasons for Survey:

A desire to bring about more effective blister rust control in Rhode Island through the eradication of all European black currants (Ribes nigrum L.) in the State, stimulated an investigation of the existing needs and conditions.

The following facts have a direct bearing on the problem:

1. The present black currant regulation passed in 1919, prohibits the planting of Ribes nigrum, but unless they are diseased this ruling does not affect bushes planted before the passage of the act. Therefore, a more effective black currant regulation or legislation appeared necessary to obtain the eradication of Ribes nigrum.

2. To determine the need for such black currant regulation or legislation, it seemed important to have better knowledge of the number of such Ribes in each section of the state. This was necessary since little information was available.

3. The importance of knowing the amount of infection on Ribes nigrum to prove their danger to white pine as well as the needed comparison in number and infection to other Ribes, created a need for a survey of all cultivated Ribes in a given area or unit. This unit survey would thus serve as an index of Ribes conditions in the state. The most desirable unit for such a survey was agreed upon as a township.

4. It was decided that a complete unit survey of all cultivated Ribes was worth while since besides collecting basic facts to be in a position to make definite recommendations as regards the need for Ribes nigrum legislation, it would be of value.

(a) To determine future control work.
(b) To determine the best field procedure in locating and eventually eradicating cultivated Ribes.

Plan of Survey:

Limited time allowed a survey of only two towns in the state this year. The following two towns were selected:

In Control Area	Reasons for Selection
Scituate, population 3,348 Square Miles in Township-55.10	No eradication carried on as yet. Such study would determine to some degree the future control work needed. The Providence Reservoir property with pine plantings is in this township.

Outside Control Area	Reasons for Selection
East Greenwich Population 4,157 Square miles in Township-15.9	Has not been eradicated of Ribes. Is situated just east of the valuable pine township of West Greenwich.

The method of carrying on the survey was by a house to house canvass treating each town as a separate unit.

The various roads and streets were followed subsequently with a road map used as reference.

The method of handling interviews was as follows:

1. Explanation as to identity of interviewer.
2. Reason for interview.
3. Presentation of blister rust bulletin.
4. The obtaining of the desired information if possessing Ribes.

(a) Needed to fill in the cultivated Ribes census card (originated by Mr. E. C. Filler) giving data on Ribes, presence of pine, and owner.

(b) To ascertain the cooperation owner will give, when necessary, depending on local conditions and the control area regulations.

The Ribes plantings were inspected for disease. The amount of infection found was recorded on the Ribes census card. When diseased Ribes were found, the pine in the vicinity, if any, was examined. A map supplementing the census card was used showing the presence of such exposed pine and the location of all cultivated Ribes plantings. The interview card-number corresponded to the number on the map showing locations of the planting.

Daily records were kept including time spent on survey, travel expenses, and desirable information obtained, of possible value in recommending black currant legislation or determining a different method of procedure in locating or eradicating cultivated bushes.

While the survey was carried on in the town of East Greenwich, a front page blister rust news article was printed in the local weekly paper to acquaint the people in regard to the disease and to mold public sentiment toward Ribes eradication.

DATA OBTAINED FROM SURVEY OF SCITUATE.

Data on Ribes	Not infected	Infected
Total number of Ribes found, given by species.		
Ribes rubrum L.	1609	42
Ribes grossularia L.	87	2

DATA OBTAINED FROM SURVEY OF SCITUATE. (Cont'd)

Data on Ribes	Not infected	Infected
Ribes aureum Puvsh	15	3
Ribes nigrum L.	None	14
	1711	61
Total Ribes in Scituate	1772	
Total Ribes infected with Blister Rust	3.6%	

14 Ribes nigrum, all diseased, were found in Scituate, in two plantations.

Total Ribes by size and condition.

	Size			Condition		
	Small	Medium	Large	Poor	Fair	Good
	93	496	1183	455	1022	295
Infected Ribes	7	23	31	3	28	30
Uninfected Ribes	86	473	1152	453	994	265

A rough estimate of what the state would have to pay out in Ribes compensation if the owners of these bushes claimed compensation is as follows:

Rating small Ribes @ $.15; medium sized Ribes @ $.35; and large Ribes @ $.50; the total compensation would be $754.45.

This compensation figure is not determined by also taking into consideration the condition of the bushes and thus is only valuable in giving a fair idea as to the maximum compensation the state would have to give if this cost was not reduced through obtaining the cooperation of the owners.

Ribes within 900 feet of White Pine

	Infected	Not infected
Ribes rubrum	11	33
" grossularia		2
" aureum		1
	11	36
Total bushes within 900 feet of White Pine		47

Data on Interviews and Contacts

Interviews with people possessing Ribes	79
Other contacts	205
Total interviews and contacts	284

Number of houses where no one was home 28
(Such places were scouted for cultivated Ribes insofar as possible.)

Period of time taken in interviews where people possessed Ribes--two to sixty minutes.

Average time per interview based on a total of 79 interviews where people possessed Ribes--nineteen minutes.

Average number of interviews per day where people possessed Ribes--6.6

Average number of all contacts per day--23.7

Data on hours spent in field:

	Total hours by projects:
Service	67-1/4
Travel	24-1/2
Total hours spent in field	91-3/4

25 hours of the 67-1/4 hours spent in service work was the total time spent with owners of cultivated Ribes. The other 42-1/4 hours were spent in other contacts. The survey was completed in 12 days of field work.

Data on cost of survey

The only cost incurred outside of the salary of the agent, was that of transportation by car at $.07 per mile.
The average mileage per day was 38.6 miles.
The average transportation cost per day was $2.70.
The total mileage of survey was 463 miles.
The total transportation cost was $32.41.
The cost of locating each Ribes was $0.018.
The cost of locating each Ribes plantation was $0.41.
The cost for each contact with individuals, giving them information on Blister Rust, was $0.11.

Actual Blister Rust control through survey:

Total people possessing cultivated Ribes	79
" " to allow crew eradication	10
" " " eradicate Ribes themselves	17
" " " watch for disease after instruction was given	14

Thus, 41 people out of the 79 interviewed are giving certain definite cooperation. The 38 other people while giving no definite present cooperation, may in the future. This is the first blister rust control contact this town has had. The opportunity to spread knowledge of the white pine blister rust through this survey should be very beneficial when actual crew ribes eradication work is started.

The total number of Ribes promised to be eradicated by the owners is 105.

The total number of Ribes that may be eradicated by the State crew with permission of the owners is 42.

The total number of Ribes that owners promised to watch for disease is 1105.

Total number of Ribes that are or may be brought under control is 1252.

This leaves 520 cultivated Ribes in Scituate that at present are included in no plan of control.

DATA OBTAINED FROM SURVEY OF EAST GREENWICH

Data on Ribes

Total number of Ribes found, given by species.	Not infected	Infected
Ribes rubrum	888	
" grossularia	146	
" aureum	3	
" nigrum	39	12
	1076	12

Total Ribes in East Greenwich, 1088. The absence of leaves in this late fall survey allowed no study of percentage of infection.

51 Ribes nigrum were found in East Greenwich in 10 plantations. 12 of these Ribes nigrum were found diseased. The other 39 Ribes nigrum had shed their leaves.

Total Ribes by Size and Condition

	Size			Condition		
	Small	Medium	Large	Poor	Fair	Good
	116	665	307	19	509	560
Infected Ribes	4	4	4		12	
	112	661	303	19	497	560

A rough estimate of what the state would have to pay out in Ribes compensation if the owners of these bushes claimed compensation, is as follows:

Rating small Ribes @ $.15; medium sized Ribes @ .35; and large Ribes @ $.50; the total compensation would be $399.65. This compensation figure is not determined by also taking into consideration the condition of the bushes and thus is only valuable in giving a fair idea as to the maximum compensation the state would have to give if this cost was not reduced through obtaining the cooperation of the owner.

Ribes within 900 feet of White Pine

	Infected	Not infected
Ribes rubrum (13 plantings)	None	222
Ribes grossularia (6 plantings)	"	22
Ribes nigrum (2 plantings)	"	5
Total Ribes within 900 feet of White Pine		249

Data on Interviews and Contacts

Interviews with people possessing Ribes	99
Other Contacts	133
Total interviews and contacts	232

Number of houses where no one was home. (Such places were scouted for cultivated Ribes insofar as possible.) 26

During the last two days of the East Greenwich survey, while working part of the village of East Greenwich, scouting was carried on wherever possible and the only door contacts other than with people possessing Ribes were at places surrounded by hedges or enclosures where Ribes scouting was impossible. This scouting was due to lack of time for interviewing each householder and a growing belief that scouting closely settled sections was as efficient and more economical if carried on conscientiously.

Period of time taken in interviews where people possessed Ribes, 3 to 30 minutes.

Average time per interview based on a total of 99 interviews where people possessed Ribes, 7 minutes, 36 seconds.

Average number of interviews per day where possessed Ribes, 9.9

Average number of all contacts per day, 23.2

Data on hours spent in field.

Total hours by projects:

Service	33-1/2
Scouting	3-1/2
Travel	23-1/4
Total hours spent in field	60-1/4

12½ hours of the 33½ hours spent in service work was the total time spent with owners of cultivated Ribes. The other 21 hours were spent in other contacts.

The survey was completed in ten days of field work.

Data on cost of survey

The only cost incurred outside of the salary of the agent was that of transportation by car at $.07 per mile.

The average mileage per day was 40.9 miles. The average transportation cost per day was $2.86. The total mileage of survey was 409 miles. The total transportation cost was $28.63. The cost of locating each Ribes was $.026. The cost of locating each Ribes plantation was $0.29. The cost for each contact with the individuals, giving them information on Blister Rust was $.12.

Actual Blister Rust Control through survey

Total people	possessing cultivated Ribes	99
"	to allow crew eradication	6
"	to eradicate Ribes themselves	11
"	to watch for disease after instruction was given	6

Thus 23 people out of the 99 interviewed are giving definite cooperation. The 76 other people while giving no definite present cooperation may in the future if necessary. East Greenwich is outside the control area and while cooperation was asked for, stress was laid on the eradication of black currants (Ribes nigrum) chiefly.

The viewpoint of the State department, is that since it is permissible to plant Ribes in sections of the town where pine is not present, it would only hurt the cause to ask for eradication of all Ribes without fully acquainting the people with the governing rules and regulations.

The news article in the East Greenwich paper did bring about the eradication of some cultivated bushes other than Ribes nigrum and in order that the state department may not be misunderstood, it may be said that it is in favor of molding public opinion to favor eradication of all Ribes when necessary.

The total number of Ribes promised to be eradicated by the owners is 73.

The total number of Ribes that may be eradicated by the State crew with permission of the owners is 13.

The total number of Ribes that owners promised to watch for disease is 37.

Total number of Ribes that is or may be brought under control is 123.

This leaves 965 cultivated Ribes in East Greenwich that at present are included in no plan of control.

There are only a few scattered white pine in the township. Thus, it is not necessary to include this town in the state control area.

Miscellaneous conclusions obtained through survey.

Information and observation gained through the contacts with many classes of people in the survey has brought about the following conclusions in the mind of the agent:

1. The chestnut blight has helped to pave the way for blister rust control in that it has awakened the people to the danger of tree diseases.

2. Blister rust may often be more readily understood if compared with other tree diseases functioning much the same, especially in the method of spreading. The cedar rust is the best example of this in Rhode Island.

3. Much information may be gained from people in regard to others having bushes. This is an aid in survey work but is not always dependable.

4. The Ribes owner's attitude is generally good if the Ribes are found to be diseased.

5. There is very little knowledge of the state rules and regulations in regard to white pine blister rust. This is a challenge to the agent to remedy the condition.

6. The majority of the people have read or have heard about blister rust but they are confused as to the manner in which it spreads.

7. People often do not relate flowering currants (Ribes aureum) to the Ribes family or to blister rust.

8. Much time may be spent in listening to farmers discuss other problems. This slows up the survey work, but the advantage of making acquaintances through such discussions are often worth while because of the moral support gained.

Conclusions

In summarizing, it may be said that the cultivated Ribes survey of Scituate and East Greenwich has given definite information in regard to the cultivated bushes in both towns. It has spread a knowledge of blister rust that should be very beneficial in the future. The survey has given information as to the cost and time required that may serve as a basis for other such work.

It may be a step in proving that such a survey before crew eradication is carried on in a town, is of great value in reducing the cost and increasing the efficiency of the crew eradication.

The field study has given the State Department of Agriculture an indication as to the per cent of infection, number and value of Ribes nigrum in the state.

A state act condemning the growing or propagating of Ribes nigrum is to be introduced at the coming session of the General Assembly for enactment.

Discussion

Riley: If ruling goes through, what is plan for enforcement?

Hurford: Commissioner Lewis believes if bill passes legislature, people will get information. Have close cooperation of state police. Work to be done on rainy days. Will see what individuals will do themselves.

Stene: Thinks they can enforce this law the same as any other. Will have to follow up work with inspections.

Hurford: Commissioner Lewis sends word that he hopes Connecticut will do something on black currant legislation.

Detwiler: In Western States, Oregon and Washington have completed cultivated black currant eradication. Other states have made good progress. About 97% of black currants are eradicated voluntarily, without compensation, if right methods are used. Pays to concentrate work in one county and have such work preceded by adequate education. Only occasional owner is adverse to removal of bushes; usually those with large plantings. Great deal of valuable educational work accomplished by contacts.

Newman: Asks how many of the Northeastern States have laws regarding black currants.

Martin: Massachusetts and New York have definite laws or regulations declaring black currants a nuisance. Michigan has just had hearing on this subject, and have declared black currants a nuisance in 16 counties where the disease has been found. Would like to see other States include this in their plans of work. Also would like to see states include blister rust nursery sanitation as one of their projects in the control program.

Hurford: Believes states should get together and decide something definite on black currant legislation.

Newman: Asks if laws in Massachusetts and New York have had any effect on impressing seriousness of other species in spreading blister rust. Believes that greater percent of black currants in New Hampshire have already been removed.

Hurford: Found very few plantings of black currants while on the work in New Hampshire, and owners did not value them highly.

Perry: Believes Newmans point on over-emphasis of black currants right and it would effect present program. In Massachusetts, they are conducting such black currant work only in those towns where local control work has been done.

Clark: Asks basis of proposed compensation rates in Rhode Island.

Hurford: Only estimates.

Martin: New York has definite scale for Ribes compensation. Copies are available.

STANDARDIZATION OF CHECKING PRACTICES

By J. D. Kennedy

Introduction.

In all lines of work carried on by a large and varied force of men, some method, either crude or well worked out, is provided to furnish a check upon the efficiency and results of the work performed. In manufacturing operations, accurate and very definite checks are provided for application to the work done, or product turned out by every employee. Any organization performing work without some system of checking is bound to become inefficient and turn out a poor quality of work. Checking provides valuable data for making changes in personnel, improving methods, and increasing general efficiency.

Ribes eradication is a problem which requires that a check be made upon every area eradicated. At best, experience has taught us that every bush cannot be found upon a given area, but this fact is no reason for not continually striving to increase the efficiency of our eradication work and reducing the leaf bearing stem left per acre.

Ribes field checks made before or after eradication are certain to tend toward increasing the efficiency of the eradication crew. The morale of the foreman and crew is automatically raised by the knowledge that a check will be made upon the work that they are paid to do. There is a felling of satisfaction to the agent and supervisory force in knowing that the eradication work is being checked and that he has a record concerning the quality of the work, and something to refer to in case of question concerning the work. Check records provide valuable data for studying field problems concerning Ribes population, size, location, habitat, leaf bearing stem, etc.

Methods of Checking.

General Check. I define this method of checking as the general observation that an agent or supervisor makes in walking slowly about an eradicated area searching for missed bushes. Probably every agent uses this method more than any other and it counts for a great deal in his mind toward forming an opinion of the quality of the work. An agent's experience teaches him where missed bushes will most likely be found, and he consciously or unconsciously looks mostly in these places. I think this is a valuable method and no doubt every agent makes such an examination of all eradicated areas, but it provides no definite record or data upon which to base conclusions or make recommendations.

Advance plot check - twin plot check. I believe every one is familiar with the advance plot check, which, of course, is laid out in advance of the crew and without the crew's knowledge. This furnishes a very accurate check for a small area, but is not a representative check for any given area in its entirety. The twin plot check, as I see it, is an elaboration of the advance plot check and, all considered, has very little,

if any, advantage over the latter. Both methods have the inherent weakness that it is impossible to lay out the plot in such a location as to be representative of the entire area. Mechanical difficulties in measuring, counting Ribes before and after, concealing boundary lines, choosing locations for plot, and time consumed, are all factors against this method.

Crew checks. The crew check, provided for on the lower half of the B. R. 1 report, is an excellent method for furnishing a crew with a knowledge of their efficiency and with a conscientious crew is very valuable toward increasing their efficiency. It is difficult of execution on small jobs and with small crews, in which cases the owner is anxious to complete the work and may object to the time used in making these checks. In certain instances a checking crew has been used which does nothing but check on areas which have been eradicated. The expense of maintaining such a crew makes it out of the question to use this method.

A point worth considering in all methods of checking is that experience has shown that a crew misses more bushes going down hill than when going up. This is due to the fact that the crew can see under the ground foliage more readily while moving up hill,

Strip line check. This method of checking has been used altogether during the past three seasons in New York, and most of this paper will deal with an explanation of this method as it is used in our work. I am distributing to each of you a copy of the form which is used in making our checks.

Mr. A. F. Amadon, formerly State Leader in New York, originated and worked out the details of this checking form.

Mr. Amadon felt that checking methods did not provide an accurate index of the efficiency of the work over an entire area and that too much emphasis was placed upon bush efficiency rather than upon leaf bearing stem left per acre. By making several strip checks over an area in gridiron fashion, a true average of conditions is obtained. The Ribes found on these strips contrasted to the total number pulled on the area, gives a more accurate estimate of the efficiency of the work for the entire area, rather than if the estimate was arrived at from data secured in one or two plot checks.

Explanation of New York check. Most of the agents in New York are supplied with an assistant whose duty it is to make checks, supervise the crews, lay out areas to be eradicated, help in interview work and any other work the agent may assign him. Most of the checks are made by the assistant, and that is why very few checks are reported in our agent's monthly reports.

You will note that the check card provides for each strip; time spent; length and width; species of ribes; classification of ribes found, by leaf bearing stem, from 1 to 100 feet L.B.S. and by heights, from 6 inches to 5 feet. Field studies have shown that a checker can closely examine a strip 6 feet wide while walking rather slowly.

RIBES CHECK -- FIELD RECORD
(Advance Check, Check Strip, or Check Plot)
INITIAL OR REWORKING

State_____ District_____ Town_____ Block_____

Date Checked (Initial / Reworking)_____ By_____ Foreman or Scout_____

Type_____ Ground Cover_____ Acres_____ Est. of Ribes Original_____ % Efficiency_____

Strip	Plot	Time	Length & Width	Species	No. Foot L.B.S.										No. Bushes by Heights						
					1	2½	5	10	25	50	75	100	Over 100	Total	½'	1'	2'	3'	4'	5' & Up	Total
				Gooseberry																	
				Skunk Currant																	
				Red & Bl. Currant																	
				Gooseberry																	
				Skunk Currant																	
				Red & Bl. Currant																	
				Gooseberry																	
				Skunk Currant																	
				Red & Bl. Currant																	
				Gooseberry																	
				Skunk Currant																	
				Red & Bl. Currant																	

The checker should as nearly as possible run his strip lines at right angles to the contour lines and stream courses. This will tend to cause the strips to cover all types of conditions and thus give an average for the whole area. The checker must not vary his course to miss or take in a bush. Every bush found on the 6 ft. strip must be entered upon the check sheet and classified according to feet of L.B.S. (Leaf bearing stem) and height. The checker counts his paces and thus arrives at the number of chains covered in the strip. Strict integrity in listing and classifying bushes must be observed by the checker; otherwise, this method of checking is an absolute failure. In order that you may thoroughly understand the check sheet, we will enter arbitrary data and compute the results.

New York check data for 1927. No doubt the results of the checking done in New York for 1927 will be of interest to you.

Number of acres checked	61,522
Total no. Ribes pulled on above	1,269,461
Number of strip checks made	1,372
Total no. Ribes found on checks	1,325
Total feet L.B.S. " " "	3,506.5
Total acres in check strips	276

Computations

Ribes.

Estimate of Ribes per acre found on checks 1325 ÷ 276 =	4.8
Total Ribes left on 61,522 acres	295,306
" " pulled on 61,522 acres	1,269,461
Estimate of Ribes originally on 61,522 acres	1,564,767
Bush efficiency percent - 1,269,461 ÷ 1,564,767 =	81%

L.B.S.

Total feet L.B.S. found on checks	3,506.5
Feet L.B.S. per acre left 3506.5 ÷ 276 =	12.7
Total feet L.B.S. left on 61,522 acres =	781,329

Discussion

I leave it to the pathologists and field specialists, to decide whether 12.7 feet L.B.S. per acre is too much to leave for the safety of the ordinary white pine stand. The amount of L.B.S. per acre left can, of course, be greatly reduced below the above figure by intensive eradication or by covering the area two or three times. This, while giving excellent checking results, would make the cost of eradication so high that it would be altogether out of proportion to the value of the pine protected.

Our check records show that 83.6% of the bushes left in 1927 were less than 1 foot in height. Past and present field studies show that a very small percent of these seedlings reach maturity due to high mortality from competition with other vegetation. They do not, as a rule,

successfully endure shading. No figures are available to show how much damage a certain number of feet of L.B.S. per acre will do, but general observation tends to show that our present methods are furnishing adequate protection to our White pine areas.

I believe pathologists agree that the amount of leaf bearing stem is the controlling factor in spreading blister rust rather than Ribes population. It then follows that our checking should be made on the basis of L.B.S. rather than mere number of bushes without regard to size or L.B.S. Some interesting figures could be obtained by having an eradication crew list the Ribes pulled by height and L.B.S. classes. This contrasted with the check record would give some real honest, accurate, check figures and no doubt very interesting.

We aim to cover in our strip checks at least one percent of the area eradicated, but we have fallen below it this year, for the check records show that slightly less than 1/2 of 1 percent of the eradicated area was covered in checks. I do not feel that this is enough checking, but the field season is a short and very busy one and the rush of eradication work often results in slighting some problems. However, as pointed out before in this paper, agents do a great amount of general checking, or observation checking, which is not reported and for which there is no record.

The strip line check, as used in New York, seems to be the only check which will uniformly cover all types of areas and conditions and result in data which can be uniformly computed for the entire state. A question has been raised as to whether the strip check will give satisfactory results on scout jobs or where the Ribes are isolated in a few small patches. This is a problem which must be overcome by the judgment of the checker. Checks laid out improperly on these areas will give erroneous and deceptive results. I am inclined to think that an observation check on scout areas will give as good or better results than any other method, but for sake of uniformity in data for an entire district or state, a strip check should be used.

Suggestions and Recommendations. I feel that some sort of standard checking practice should be adopted for use throughout the Northeast, whether it be a strip check, plot check or something entirely new. I will offer the suggestion that the Boston or Washington Office conduct experiments with different checking methods and select some system which can be adapted to this entire Northeastern district. This will tend to give uniformity in checking reports and other statistical data.

Improvement should be made in the agents' monthly report in the space which is provided for reporting checks.

Discussion

Riley: Have any checks been made on estimates of distances paced? Experience in Conn. has shown that pacing is usually considerably off. Asks cost of check work.

Kennedy: No check made on pacing. Personally does not believe such an error would affect results. No figures available on costs.

Fivaz: A 0.45 percent check is too small to be significant.

Detwiler: In the West, standard checking system is 2% of the area worked and the strip line check is used. Leaf bearing stem is that part of the live stem which bears leaves, and live stem is total. Have data crew for checking in West. 90% efficiency this year as compared with about 76% in earlier work.

Newman: Have adopted checking form in New Hampshire. Their inspectors check stream courses, swamps, and fence rows. Acreage based on average width of strip. No credit given for general checking.

McIntyre: Should consider what percent of bushes found on checks are suppressed and never would amount to anything.

Littlefield: Checkers in New York are trained in pacing. Errors of different men tend to compensate differences. Their original idea in 1927 was to check about one percent of the total area worked.

McCubbin: Error in pacing not so important in compiling final figures.

Martin: Number of bushes per acre is not so important - it is amount of live stem per acre.

Richardson: Recommends that change be made in checking part of monthly report so as to include general checking.

Endersbee: Uses strip method. Weakness he sees in this system is lack of classifying Ribes types.

King: How far apart are strips?

Kennedy: Fifty to one hundred yards.

Endersbee: Strip check for some definite record to show state leader - general checks to satisfy yourself as to quality of work.

Riley: Why not check whole block to get accurate figures?

McIntyre: Crew will not do same quality work each day.

C.E.Baker: One job he checked showed 95% efficiency, while another project worked by the same crew was so poor they did it over.

A BRIEF REVIEW OF SOME RIBES STUDIES IN NEW YORK STATE

By E. W. Littlefield

The data from a few of these studies may be of interest as contributing to some of the discussions at this meeting. The matter of Ribes sprouting from roots has already been discussed at considerable length and need not be gone into further at this time; it is hoped to have the results from this part of the work ready for publication at an early date.

Examination of some 500 seed spots (both naturally and artificially sown) which have been under observation since 1923 indicate that, where conditions are at all favorable the bulk of the germination takes place within two or three years from seed deposition. Although seedling mortality has been high, there are areas where the prospect of restocking from seed naturally deposited on the site of eradicated bushes seems fairly certain.

The effect of light burning on an area stocked with Ribes glandulosum Graver was apparently favorable for the establishment of Ribes seedlings. The area was burned in 1925 and small plots totalling about 3000 square feet were laid out. An examination later in 1925 showed nearly 1000 seedlings on the plots, or about 30 per 100 square feet. In 1926 there were 649 seedlings, including 73 of current year's germination. Observations on this area are being continued.

Another example of the reproductive capacity of R. glandulosum has been found where a mass of these bushes were eradicated from a rock pile about 2 square rods in area. The year following eradication, 207 Ribes seedlings were found there. Observations are being continued on this plot, also.

Studies with regard to re-eradication include a number of permanent quarter-acre check plots which are to be examined periodically; and a re-eradication of a 10-acre area at Deerhead, N. Y., after a five year interval. A report on this latter project was written for the Blister Rust News last summer.

BLISTER RUST IN MICHIGAN

By E. C. Mandenberg and D. J. Stouffer

INTRODUCTION

History of the Rust in Michigan.

Scouting for white pine blister rust in Michigan began in 1916 and has been generally carried on during the summer months since. There was no scouting done in the years of 1924 and 1926. The disease was first discovered in the state in 1917 on imported pine in an Oakland county nursery. More infections were found in Oakland county in the years 1918, 1919, and 1922. Kent county in the western part of the state was found to be infected in 1922 and again in 1923. No white pine blister rust had since been found in Michigan until this year - 1927. Most of these infections were primary and occurred on imported seedlings. In 1922 there were a number of secondary infections on Ribes and one or two on pine.

RIBES SCOUTING FOR RUST

Location of Work.

It was decided to scout in two groups - one to carry on intensive work in the region of the old infections in Oakland county - the other to do extensive scouting in the "Thumb" area. Soon, however, as the project produced no infections, with the exception of a single young infection on pine, the intensive method was given up in favor of the wider range method. The result of the first week of scouting was amazing to all concerned. A check up showed six counties were found to be infected in those first few days.

Plans were then laid to try and find the limits of the spread of the disease by making only a few stops in a county and these further apart. The intensity of the infection seemed to decrease as we traveled westward from the Lake Huron shore. However, scouting was continued farther west with the result that a new infection was located in the central part of the lower peninsula. The infection again seemed to disappear as the region near Clare was left.

Two infected counties which are as yet removed from any other infected county were found in addition to these two larger areas of infection mentioned above. Oceana county, on the Lake Michigan shore, and Cass county in the southwestern part of the state are seemingly stray shots but further scouting will no doubt connect them up with some other infected counties. The Cass county infection was reported by Mr. G. C. Cowdrey.

Samples of infection from all counties reported, except Mecosta, were identified as Cronartium ribicola Fisher by Mr. F. C. Strong of the Botany Department of Michigan State College. This was simply a check identification.

Distribution of Ribes.

Cultivated Ribes including R. nigrum L. were found to be well distributed throughout the more thickly settled areas of the central part of the lower peninsula, especially in the towns and villages. In the farming districts of the "Thumb" area, as well as in the towns and cities, Ribes were cultivated quite commonly. Wild Ribes were generally distributed in the areas scouted. Species noted were R. americanum Mill, cynosbati L., triste Pall., and hirtellum Michx. R. glandulosum Grauer was reported at Farwell in Clare county, but report was not checked by this office. R. nigrum was by far the leader in number and intensity of infection. Wild Ribes were found infected in a few instances as were cultivated red currants and flowering currants.

Results.

Total counties scouted - - - - - - - - - - - - - - - - -	38	
Total counties infected 1927 - - - - - - - - - - - - - -	17	
Total counties infected previous 1927 - - - - - - - - -	2	(1 again in-
Total counties infected- - - - - - - - - - - - - - - - -	18	fected this
Total area of 18 infected counties, 7,708,160 A.		year)

Total Ribes infection locations- - - - - - - - - - - - -	56
R. nigrum infections - - - - - - - - - - - - - - - - - -	52

R. aureum infection locations- - - - - - -	2
R. cynosbati infection locations - - - - - -	2
R. vulgare infection locations - - - - - - -	1
R. americanum infection locations- - - - -	2

Note - Some locations have more than one species

Total pine infection- - - - - - - - - - - - - 1 infected

PINE SCOUTING FOR RUST

Location of Work

Extensive pine scouting was carried on in connection with the Ribes scouting. This consisted in hurried inspection of pine reproduction chiefly as it was noted for future work. The intensive work was done largely after the Ribes had become nearly defoliated. It was confined mainly to the counties of St. Clair, Sanilac, Macomb, Clare and Midland. These counties were chosen due to their location in regard to intensity of infections, proximity of pine to infected Ribes particularly R. nigrum, the abundance of pine, and favorable physical conditions for the germination of the rust. These conditions were noted and recorded as observed on the Ribes scouting trips.

Distribution of Pine.

White pine was found to be making good growth in all the sections scouted. This fact bears out the assertion that the white pine is adaptable to practically all our conditions in Michigan. Reproduction varied from excellent to poor. In some locations the pine is coming in well under hardwoods. Along the Black River valley in St. Clair and Sanilac counties,

the Belle River valley in St. Clair and Macomb counties, and the Muskegon River valley in Muskegon, Newaygo and Montcalm counties are the best stands of reproduction and middle aged trees scouted. The best stand of older pine seen was in the county of Crawford.

Results.

Approximate acreage White Pine scouted	7,000
Infections Found	0

Note - One pine infection found during Ribes scouting.

There are two theories advanced to explain the widespread of the rust found in Michigan this year: 1. That there are centers of infection within the state having well advanced pine cankers. 2. That due to the weather conditions, aeciospores from nearby infection areas outside the state caused the spread. The latter conclusion seemed to be substantiated by the pine scouting as no old cankers were found and only one small young canker was discovered while scouting Ribes. Further data may establish either one or both of these theories but it is too soon to draw final conclusion.

NURSERY INSPECTION FOR BLISTER RUST

General Nurseries.

Several nurseries growing either or both hosts of the white pine blister rust were given thorough inspection this year. Conditions in these nurseries and near by were in some instances favorable for infection while in other cases they were found to be sanitary with regard to the rust. It was especially noted that both hosts were grown on the same farm of one or two of the nurseries. R. nigrum was found to be growing within a mile radius of pine in others.

Forest Nurseries.

Thorough inspection of the three principal forest nurseries supplying white pine for planting in Michigan was made this season. Conditions indicated that the major sources of our white pine seedling supply were fairly sanitary, but that some eradication work should be done the coming season as wild Ribes are too near for safety at two of the nurseries, and cultivated Ribes are the offenders at the third.

REMARKS

Season of 1927.

The season of 1927 was most opportune for the resumption of blister rust control work if we are to judge from the results obtained. Previously only two counties in the entire state were known to be infected but sixteen more were added to the list this year. The distribution of the infected counties and the infections within these counties divides the area into two roughly defined districts. The largest and most severely diseased area is known as the "Thumb". Here are many very marked infections on black currants and several on less susceptible species such as R. americanum, cynosbati, vulgare Lam., and aureum Pursh.

The second district is centered about Clare in the central part of the lower peninsula. The infection here is not so pronounced and seems to fade out quickly as one travels away from Clare. Kent country was not found to be infected this year though considerable scouting was done there. Two smaller districts comprising one county each are as yet isolated from the others.

Through the active interest of our Commissioner of Agriculture, Mr. Powell, and other members of the State Department, white pine blister rust was dealt a severe blow. A very successful black currant hearing was held last November in which testimony showed that the white pine was more valuable to the welfare of the people of the state than are black currants. As a result of this meeting the Commissioner issued a Public Notice declaring the black currant be eradicated from the sixteen counties then infected. Tuscola and Bay have been added since.

EUROPEAN BLACK CURRANTS TO BE ERADICATED IN 16 COUNTIES IN MICHIGAN

STATE OF MICHIGAN
DEPARTMENT OF AGRICULTURE
BUREAU OF AGRICULTURAL INDUSTRY

PUBLIC NOTICE

As provided for in Section 20, Act No. 142, Public Acts of 1927, I, Herbert E. Powell, Commissioner of Agriculture, having heretofore, to-wit: on the tenth day of October A.D. 1927, issued call for a public hearing as by law provided, for the purpose of giving parties interested a chance to be heard on the question of whether or not the European Black Currant growing within this State is a nuisance as defined in section 18, of Act No. 142, Public Acts of 1927, and such public hearing having been held at the offices of the Commissioner of Agriculture in the City of Lansing, on the 22nd day of November, A.D. 1927, at 10 o'clock A.M., proper and legal notice of such hearing having first been published.

Having listened to the proofs and allegations made at such hearing by all parties concerned, it is by me this day adjudged and determined that in the Counties of Cass, Kent, Oceana, Osceola, Clare, Mecosta, Isabella, Midland, Saginaw, Genesee, Oakland, Macomb, St. Clair, Lapeer, Sanilac, and Huron, the European black currant is to a considerable extent infected with White Pine Blister Rust. It is further adjudged that the European Black Currant is an alternate host of the White Pine Blister Rust, a serious and dangerous disease which threatens the white pine of the country.

I further find that white pine in the counties enumerated is essential to the welfare of the people of the State and that the European Black Currant growing in these counties is not essential to the welfare of the people of the State, therefore, it is herewith adjudged and determined that in the said counties of Cass, Kent, Oceana, Osceola, Clare, Mecosta, Isabella, Midland, Saginaw, Genesee, Oakland, Macomb, St. Clair, Lapeer, Sanilac, and Huron, the European black currant be eradicated.

This order to become effective on the twelfth day of December 1927.

IN WITNESS WHEREOF, I have hereunto set my hand and the official seal of the Department of Agriculture, this Fifth Day of December 1927, A.D.

Herbert E. Powell
Commissioner of Agriculture

PROGRESS REPORT ON 1927 BLISTER RUST SURVEY IN PENNSYLVANIA

By Wm. A. McCubbin

A school survey for white pine blister rust on a state-wide basis was undertaken in 1927 for Pennsylvania as a cooperative project between the Federal Bureau of Plant Industry, Office of Blister Rust Control and the Pennsylvania Department of Agriculture.

The project aimed to put in each school in the state, outside the two large cities of Philadelphia and Pittsburgh, a packet containing instructions to the teacher, a sheet of information, colored illustrations of the rust on Ribes, ten small envelopes for specimens, a return franked envelope and a report form. About 14,000 packets were thus sent out to be distributed by the County Superintendents to their schools.

The returns are not all in at this date but a partial summary of the results from the first 1,600 schools reports is available. Reports, few or many, have come in from 52 counties of the 67 in the state. These 1,600 schools recorded examination of 12,687 gardens and sent in with their reports 6,832 envelopes containing leaves which were thought diseased or suspicious. Of these 6,832 envelopes, 484 contained Ribes leaves bearing blister rust. These specimens came from 237 schools scattered in 36 different counties.

In addition to the above the ordinary scouting program has recorded the presence of rust in five counties additional to those covered by the school survey, and all these five (Bucks, Monroe, Luzerne, Columbia and Clarion), with the exception of Monroe, are new counties for rust in the state. A sample of the material used in this school survey can be obtained from Dr. McCubbin, Bureau of Plant Industry, Harrisburg, Pa., or from the Washington Office of Blister Rust Control.

MAKING WINTER WORK OF BLISTER RUST AGENTS MORE PROFITABLE

By H. L. McIntyre

This subject might well be given serious thought and prolonged discussion. It seems that profitable winter employment for Blister Rust Agents is a problem of outstanding importance. It cannot be reasonably expected that any project will function, with even a fair per cent of efficiency, if reimbursement for services performed covers the entire year and in return only a few months of actual or profitable service is rendered. It is seriously embarrassing and monotonous to an active man when he finds only limited or rather unimportant problems needing attention. When he cannot satisfy himself that something of importance is being done, or noteworthy progress is being made, his interest in the problem will quite likely be lessened. In addition, there is the public opinion to be satisfied. It is hard to convince a group of citizens that a certain campaign is of importance, with the thought in the community that the agent is asking their cooperation, solely for lack of other important work. To even hope to obtain maximum results, it seems necessary that the importance of our program be demonstrated through utmost aggressiveness by our representatives at all seasons of the year. In other words, if conditions warrant keeping a Blister Rust Agent in a certain district, that condition should furnish a live agent ample and profitable employment.

The nature of profitable winter employment is not for any one leader to define. What would prove profitable work in one section could well be classed of minor importance, or entirely impracticable, in another. Each leader and his cooperator can probably best plan profitable work for their agents, outside of the regular eradication season.

Beside new in the Blister Rust control work, particularly as Leader, there is little of importance that I can offer to solve this problem. I can look back quite a few years as supervisor of field work of a similar nature and experienced little difficulty during that time in finding profitable employment for all members of the organization at all seasons of the year. The difficulties encountered then were primarily financial limitations, forcing operation on a restrictive basis, not lacking the opportunities of offering important employment.

About all I can offer is to outline what has been planned as profitable employment for the Blister Rust Agents in New York State. If these plans offer any suggestions of value to other leaders, it will be gratifying to know that the time put in in the preparation of this short paper has been for a profitable purpose.

First - Woodland Type Mapping.

In a well laid out program of any description, the usual procedure is to first make a complete survey of the job, which is used as a basis for future plans. The Blister Rust control problem is not different. In states where a complete survey of the forest cover has not been made, there can be found tremendously important winter employment for Blister

Rust Agents. After the deciduous trees have lost their foliage, the coniferous species stand out prominently and such areas can be designated quite accurately on proper maps. Lack of deciduous foliage also enables the mapper to cover considerably more territory in a given time than could be covered when the forest is covered with leaves. Therefore, both accuracy and economy make the winter the most favorable time for woodland type mapping. Personally, I do not feel that this type mapping should end with the White Pine survey records. Other forest types can be secured at the same time without adding appreciably to the initial cost, but adding considerably to the value of the survey. We cannot foresee what conditions may arise that will be equally as detrimental to the reproduction of other forest types as Blister Rust is to the White Pine. Another point in favor of having the forest type mapping indicate as nearly as possible the entire forest cover, is in our present reforesting program we are wondering what type of growth was found years ago on the idle lands of today. If such information were available, it would without doubt solve many of the perplexing problems that we are now trying to master. Let us profit by this experience and leave behind records of value for the foresters of the future.

In the survey that is being made in New York State, the maps denote deciduous and coniferous growth and open country is also indicated. Every woodland block is, of course, definitely bounded, either circled by roads, or partially by roads and prominent bodies of water, such as lake or rivers, completing the boundary. Whatever part of that block is woodland is indicated on the map with colored crayon. Where different types of growth appear in appreciable quantity in a block, different colors are used to designate the different species. Further, a card record is made, numbered to correspond with the number that has been assigned the block on the map. At present our card records are prepared primarily for Blister Rust purposes, but rather elaborate and authentic records for future use might well be secured.

Second - Scouting for Pine Infection.

The Blister Rust Agent's time can be more profitably used during the eradication season than scouting for pine infection, particularly on areas previously worked. If there is not some attempt made to secure data on the amount of pine infection in winter months, information on that phase of the Blister Rust problem will surely be lacking. Here, again, is found profitable winter employment for the Blister Rust Agents, as follows:

(a) Scouting for pine infection where the disease has not been reported;

(b) Scouting for pine infection in areas that have been eradicated, as against areas in the immediate vicinity that have not been eradicated;

(c) Scouting for serious pine infections on properties of the skeptical, or otherwise known as "hard nuts".

(d) Scouting White Pine plantations for progress, disease and insect records.

Third - Survey of Cultivated Ribes.

The rush of activities during the field season is probably the chief cause for lack of thought on the possibility of cultivated black currants, Ribes nigrum L., being present on many places one passes by during the summer months. There is no doubt that this species of Ribes is much more prevalent in every Blister Rust Agent's district in New York State than is anticipated. In States with a law similar to that of New York State, prohibiting the growing or possession of Ribes nigrum, there is an opportunity to extend the Blister Rust eradication season well into the fall and winter months, at least until deep snow makes the work prohibitive in scouting for and destroying these bushes.

There is an added value to the ribes survey. The educational value alone, even though few cultivated ribes were found, would seem to make this worth-while winter employment.

Fourth - Nursery Sanitation.

It is now next to impossible to foresee what the attitude of towns, counties and even states, particularly those now deeply interested in reforesting, may later be toward admitting within their borders stock that cannot be reasonably declared free of disease. It seems that there are wonderful opportunities for a lot of good missionary work along these lines among the multitude of nurserymen in the white pine growing districts of the United States. Many of our nurseries are handling some white pine. Although white pine is not in great demand for ornamental purposes, a few for special calls must be kept on hand, or ready access to a supply is essential. The condition that exists in the environs of such a nursery is important in our Blister Rust control problem. It seems equally important that our program should include a policy to eliminate, insofar as possible, the distribution of Blister Rust disease through shipments of White Pine, inter-state or otherwise, as well as extend the control program on private and State lands. Much of the nursery ribes survey, particularly as it applies to the cultivated species, can be made at a time when regular eradication work would not be feasible. This work is now in progress in New York State.

Fifth - Educational and Service Work.

It is probably best for a new leader to limit his remarks on the value of winter educational or service work. It appears to be the concensus of opinion of more experienced leaders and agents that little can be accomplished in either during the winter months. However, the agents in New York State are usually anxious to retain assistant agents and exceptionally good foremen, after the eradication season is over, for interview and scouting purposes. If it is important that these recommendations be followed in the late fall and early winter, it surely brings up the question -

"Why is not that profitable employment for the agent?" It does not seem possible that an agent would recommend that his department should employ men on a project that was not profitable work for himself.

The great draw-back to interview and service work, as far as I can now see, lies in our present day mode of travel. When the use of motor equipment ceases, to be practicable, field work is automatically discontinued. It does not always follow that if motor equipment cannot be used to reach a certain point the importance of getting there is lessened. The value of a problem can often times be illustrated by the special effort that may be involved in putting the missionary work across. That, at least, is the line of thought that is frequently expressed by those we seek to reach. In spite of the fact that the policy of fall and winter interview work is not now generally approved, it is still in progress in New York State with Blister Rust assistants and foremen, as well as agents, doing the interview work, and which present plans indicate will be continued, even after the snow has covered the ground. As accurate a record as possible of this interview work is being kept. The returns for this expenditure can be easily tabulated another year.

Insofar as educational work is concerned, one can easily believe that the remote and inaccessible communities doubly appreciate entertainment during the winter months. Here, again, it does not necessarily signify that because these communities are not accessible by auto, the value of holding meetings is diminished. It should be expected that the attendance at any meeting in a small community will be rather limited. This can be overcome by increasing the number of meetings, also by making arrangements for these meetings in a greater number of communities.

Even though a special effort is required to arrange for lectures or other forms of entertainment in such communities, they should fully re-pay for the energy and time that we must expect should be spent to get this problem in a proper light before the property owners. We should not expect that the only avenues of approaching the Blister Rust problem in a whole-hearted manner are over cement roads or those on which no barriers are found.

Discussion

McIntyre: Stressed the importance of the preparation of type maps.

Fivaz: Wished to stress the importance of indicating on such maps age classes of pine and degree of stocking.

McIntyre: Argued that too many maps are difficult to file and be serviceable.

Kennedy & Cullen: Maintained that it is not feasible to attempt to go into too much detail.

Fivaz: Insisted that detail is necessary to make the maps serviceable for the future as well as for the present.

King: In further reference to the scout maps, as prepared in New Hampshire, wished to emphasize the fact that these blister rust maps are of service in other forestry work in the State.

Riley: Reported that nursery sanitation work and the locating and mapping of pine in towns where pine is scattering, will be special projects for winter work of the agents in Connecticut.

Perry: Also reported that special emphasis will be placed on the determination of the advisability of working towns in Massachusetts where pine is scattered. Additional work is also planned in locating blister rust on pine in a number of towns in the State where no record has ever been obtained.

IS RE-ERADICATION NECESSARY

By P. H. Merrill

This study does not cover the field thoroughly enough to reach definite conclusions. The data gathered so far, however, points to the facts which I am submitting herewith.

Is re-eradication necessary? Yes, if you want to protect your white pine. It must be re-eradicated from two years on, after the initial eradication, depending upon several factors.

1. Number of Ribes at initial eradication.
2. Efficiency of the initial eradication.
3. Kind and age of Ribes.
4. Character of terrain.
5. Character of plant growth.
6. Prevalance of Ribes adjacent to eradicated area.
7. Ribes seed that may be stored in duff and young Ribes seedlings.

1. The greater the number of Ribes at the initial eradication; the greater the number of Ribes that will be missed; the greater the chance of leaving more roots or crowns and the greater the chance of seed that has been sown.

2. If many bushes have been skipped or not properly pulled, the more immediate is the need for re-eradication.

3. The older the bushes, the greater the amount of available seed. Skunk currants appear to send up more sprouts than some other Ribes species.

4. On swampy or ledgy areas the site is conducive to an abundance of Ribes.

5. If we have a dense pine forest there is not so much chance of there being a regrowth of Ribes as in an open hardwood or pine area.

6. If there are adjacent areas without the barrier zone which have not been eradicated, there is a good chance of getting seed distributed thruout the area by birds and animals. Ribes eradicatiom records for the past five years show that there are in Vermont on pine areas approximately ten Ribes per acre.

7. We know that certain coniferous seeds will hold their vitality for several years when stored in the duff. There may be numerous Ribes seeds from the past or previous seasons, which are awaiting a chance to germinate. By pulling a Ribes bush it may put some of the seeds in contact with the mineral soil. Then, too, on many areas there are numerous one and two year old seedlings which are very difficult to locate, especially, if there is a heavy ground cover.

The following table gives the actual conditions as found on 23 areas which were re-eradicated during the seasons of 1926 and 1927.

RE-ERADICATION DURING 1926-1927

No. yrs. since Initial eradication	No. of Eradication jobs	Ave. No. Ribes per acre removed at	
		Initial erad.	Re-eradication
1	1	84	4
2	3	10	11
3	4	3	2
4	6	11	6
5	7	7	4
6	1	3	2
7	1	1	1
Totals	23	16	5

It will be noted that from two years on after the initial eradication that there were approximately as many Ribes per acre removed, as at the initial eradication. In some of these areas there were more Ribes per acre removed at the time of re-eradication than at the initial eradication.

The average number of Ribes per acre on the eradicated area may be much lower than you would get on a specific acre of the area, where the study plots were located.

Practically all the jobs were done under the supervision of the same agent and in some places by the same crew foreman. Those areas which showed too great discrepancies were not included in the summary. The areas eradicated were partly open grown and partly brushy. Some of the areas were plantations; some pure pine stands of various ages and others were mixed stands of pine and hardwoods.

Ribes species removed were Americanum, hirtellum, cynosbati, prostratum, and lacustre. Some places had chiefly seedlings; others sprouts, whereas on some areas there were both seedlings and sprouts.

The Ribes were found in some areas only along fence rows and road sides while on other areas they were restricted to wet or rocky places. In some areas they were generally distributed.

In each of the three Blister Rust eradication districts sample plots were laid off by each agent. In all eighteen plots were established. In two districts the plots were half acre in size and, in the other, they were acre plots. These plots were laid off at random over the areas which had been eradicated. The plots were located in areas which were eradicated in different years and which had different species of Ribes growing on them under different conditions of site, topography and forest composition.

On each plot the following information was tabulated: (1) Owner's names and address; (2) Location of plot; (3) Date of initial eradication; (4) Kind of Ribes found by seedlings, sprout or missed bushes; (5) The location of Ribes on the plot; (6) Rate of growth of individual plants by years showing origin; whether seedling or sprout.

The following table gives the data on the plots showing the condition of the areas at the time of eradication and the number and kind of bushes per acre on the sample plots.

PLOT	LOCATION	DATE ERADICATED	ACRES ERADICATED	RIBES PULLED	RIBES PER ACRE	RIBES ON PLOT--1927	RIBES PER ACRE
						½ acre plots	
A	Brattleboro	1925	150	373	2	6 wild gooseberry-seedlings	12
B	Newfane	1923	108	691	6	11 " " " -seedlings	22
C	Newfane	1925	150	400	3	18 16 skunk currant sprouts	
						2 skunk currant-seedlings	36
D	Newfane					1 gooseberry-seedling	
E	Brattleboro	1922	200	1276	6	9 gooseberry-6 seedlings-2 sprouts-1 missed.	18
F	Newfane	1924	319	321	1	4 escaped red currant seedlings	10
						1 P. gooseberry sprout	
G	Hartford	1923	55	27	½	10 gooseberry-8 seedlings-2 sprouts	20
H	Hartford	1923	200	1695	8	2 gooseberry-sprouts	
						5 red currant-4 seedlings-1 sprout	14
I	Hartford	1923	130	1109	9	7 gooseberry-seedlings	14
J	Hartford	1925	110	1267	11	1 gooseberry-sprout	2
K	Hartford	1925	110	1267	11	None	
						ACRE PLOTS FT. of L.B.S.	
L	Rutland	1923	75	3896	50	None	
M	Rutland	1926	160	503	3	1 gooseberry-seedling 1½	
						6 skunk currant-sprout 4,2,5,4,7,3	7
N	Rutland	1926	480	1391	3	2 gooseberry-1 sprout 14	
						1 seedling 4	2
O	Proctor	1925				4 gooseberry-seedlings 4,70,35,28	4
P	Proctor	1925				2 Americanum sprout 16-3	
						3 gooseberry- 1 sprout 7	
						2 seedlings 17,6	5
Q	Pittsford	1923	120	913	7	1 gooseberry-seedling 8	1
R	Mendon	1926	490	231	1	110 skunk currants-sprouts	110

These 18 plots show that within two to five years after eradication that there were as many or more Ribes per acre as originally. You may say that the plots exaggerate conditions. Perhaps they do, however, they give actual conditions as reported by the agents. The plots were located with a view of giving an average picture of the area eradicated. There is reason to believe that in five years after eradication that you might find more Ribes per acre than originally. Pulling of Ribes bushes makes a better seed bed and several bushes come in as sprouts from roots and root crowns.

The following tables gives the number of seedlings per acre by species which came in on the study plots.

Plot	Date Erad.	Kind of Ribes	1927 half acre plots. Age of seedlings found 2 yr.	3 yr.	4 yr.	5 yr.	Total Number
			Number				
A	1925	Prickly gooseberry	1	2	2	1	6
B	1923	Prickly gooseberry	5	3	2		10
C	1925	Skunk Currant					
D	192	Prickly Gooseberry			1		1
E	1922	Prickly Gooseberry		4	2		6
F	1924	Red Currants	2	2			4
G	1923	Prickly Gooseberry		4	4		8
H	1923	Red Currant	1	3			4
I	1923	Prickly Gooseberry		2	4	1	7

Is re-eradication necessary on all areas? No, there are many cases where from an economical and silvicultural standpoint it is not necessary. Even in some such cases initial eradication is not necessary.

The following table gives a summary of eradication work in Vermont from 1923-1927 inclusive.

Years	Acres of Pine Cleared of Ribes	Ribes Erad. Cost	Erad. Cost per Acre	Total Cost State	Federal	Grand Total	Per A.
1923	8920	8498.43	.95	10200.69	12198.84	22399.53	2.52
1924	5155	9280.02	1.80	9878.18	11984.46	21862.54	4.24
1925	5434	9058.12	1.65	10509.13	11126.30	21635.43	3.94
1926	5434	10335.44	1.89	11435.42	10223.41	21658.83	3.98
1927	5927	8829.95	1.40	9193.00*	10500.00*	19693.00*	3.32
Total	30920	45,401.96		51,216.42	56,033.01	107,249.43	
Ave.	6184	9080.39	1.54	10,243.28	11,206.60	21,449.88	3.60

* Estimates.

The average cost per acre of pine protected during this five year period is $1.54. This figure includes only actual eradication charges. If you figure in the overhead of the State and Federal expenditures it brings this figure up to $3.60 per acre.

We figure in Vermont that a fully stocked stand of planted pine on an average site will have a yield of 40,000 board feet at 60 years. If this area has to be eradicated once in every five years at a cost of $1.54 per acre there would be a charge of $101.53 against the forest crop, when 4½% compound interest is used. An annual land tax of $.10 per acre equals $8.94. Annual Fire Protection Costs of $.01 per acre equal $2.89. The average stumpage value per acre is estimated to be $400.00.

However a dense pine stand need not be re-eradicated more than four or five times and probably then only around the bounds of the stand. This would make a charge of about ten percent against the value of the standing crop.

SILVICULTURAL

It seems to me to be folly to eradicate any land of Ribes so that white pine may be planted. The Vermont Forest Service discourages the planting of white pine on Ribes infested areas.

It will be seen from the table on page 5 that on Plot A there were two 4 yr. old seedlings and one five year old seedling which were two, three and four inches high, respectively when the area was eradicated in 1925. Naturally these seedlings were too small to be noticed at the time of eradication. On the other plots A-1 inclusive all the seedlings found, came in after eradication. These seedlings included prickly gooseberries, escaped red currants and skunk currants.

RATE OF GROWTH OF RIBES CYNOSBATI SEEDLINGS AND SPROUTS

From measurements taken on 36 seedlings located on several different plots, the average rate of growth was determined for the first four years to be; 3,5,7 and 9 inches, respectively. Of course, I have not enough measurements to make a definite statement as to the rate of growth; however, they give an inkling of their growth in Vermont. There were not enough seedlings of other varieties to draw conclusions as to the rate of growth. Sprouts of Ribes cynosbati L. showed the following rate of growth from 20 measurements. The average rate of growth for the first five years was 15,7,8,10 and 6 inches respectively. In very few cases were there any sprouts over four years old. From observation it appears that Ribes cynosbati L. sprouts, as a rule, live for only about four years and then die down.

It is my opinion that it is uneconomical to re-eradicate certain areas.

Such areas are:

1. Mature and nearly mature pine stands. Such areas should be eradicated just previous to the time that they are opened up by a reproduction cutting.

2. Understocked and poor quality pine will not stand the cost of eradication.

3. Pine stands which have at least fifty per cent of other species or an open grown stand in which the reproduction is chiefly other than white pine.

In many places re-eradication might not be necessary if we knew positively the susceptibility to damage of different ages of pines and the infecting power of different species of Ribes.

(Before reading his paper, Mr. Merrill gave a brief description of the recent flood disaster in Vermont, especially in Montpelier.)

Discussion

Rose: Knows pine owners in Vermont will re-eradicate, but are we justified in recommending re-eradication at a certain time without making a study of the subject. In his mind, it is a problem of selective re-eradication. One ½ acre plot studied was originally eradicated in 1923. 17 bushes had come back in 1927 - also 2 sprouts. Counted 11 seedlings in one spot where large bush had been pulled. The majority of the bushes found in re-eradication are along roadways and fences, and around cellar holes where large bushes were pulled originally.

Cullen: If in 2-5 years Ribes are going to resume their original abundance, isn't money spent in the first eradication wasted if the bushes are not re-eradicated?

Rose: Does not advocate no eradication, but selective re-eradication.

Detwiler: Asks Merrill if data was obtained on number of bushes which bore fruit.

Merrill: The data was obtained after fruit had dropped. Tells of conditions in vicinity of Fairlee, Vt. demonstration area. Native pine cut off area north of study plot, and large Ribes cynosbati have come in since eradication. No bushes in dense pine stand nearby. Bushes not missed. Pine infection abundant in study area.

Detwiler: No infection on this area in 1917.

Filler: Asks for data on Live stem.

Bradder: Live Stem of bushes found left from initial eradication as high as 20-30 feet, four years after eradication. In another area eradicated three years ago, only seedlings and a few sprouts were found; averaging less than 1 foot Live Stem per bush.

Newman: In New Hampshire, necessity of re-eradication was not fully appreciated when they undertook original project. Early records not complete enough so they can make any comparison at present. Live Stem not given consideration in early years. One area of 176 acres, eradicated in 1917 and re-eradicated in 1921, data shows that better than 90% eradication was done in original work. Extremely gratifying to find the small number of bushes found in re-eradication in good many cases, while on some areas Ribes come-back astounding.

Detwiler: Data could be obtained on re-eradication and compared with data for present original working.

Riley: Is important question "efficiency of early work" or "what has happened to stand since eradication". If stand is opened by cutting, big need for re-eradication. Knows of one area, recently cut over, where there are more Ribes now than when original eradication was done.

Endersbee: In areas re-checked in Colebrook, Conn. tree growth had changed since initial control work. Majority of Ribes found on checks were in slash or cut over areas. Problem of re-eradication is going to be determined largely by adequate records taken on initial eradication. We ought to outline on maps those areas where Ribes are heavily concentrated. Other areas will probably not have to be gone over very often in future.

Merrill: Feels that there are certain places where there is no need for re-eradication. Asks for opinions of others on points brought out in his paper.

Richardson: Asks Vermont policy as regards planting white pine on Ribes areas.

Merrill: Believe that Ribes-free areas should be found in planting white pine. It is economy to consider silvicultural factors in selecting planting sites for white pine, especially at its present value in Vermont.

Riley: Use judgment in picking sites for white pine planting.

Littlefield: Is it logical to ask man to put money into control work if he is not going to make any attempt to practice silviculture? Unlimited chance for work in this field.

Detwiler: Believes Merrill and Riley are right when it comes to selection of planting sites. Problem we face is to maintain at the highest capacity the acreage of natural pine land capable of producing white pine. In the West, project "Ribes Ecology" shows that problem of blister rust control will be largely one of silvicultural management. Studies show that most of Ribes seeds lie right in the forest area and do not germinate for a number of years. Some species show growth of foot to fifteen inches the first year. Fires have bearing on Ribes reproduction. If we know Ribes ecology laws, we can use them to advantage in conducting blister rust control at the lowest possible cost.

Frost: Believes cut over areas where Ribes come in heavy after the cutting, should be looked over within a few years to protect adjacent protected areas.

Filler: Checking at Wolfeboro, N. H. showed that greatest amount of re-growth of Ribes was along fence rows and in light brush areas. Few escaped reds found along edges of pine stands; very few Ribes in dense stands.

Riley: Have found 85% initial eradication stopped spread of the disease at Colebrook, Conn.

Harpp: Re-eradication in New York shows that even if initial work was not first class it was a great help in stopping spread of the disease. Believes whole matter of re-eradication is one of common sense in applying proper methods to each individual area.

Riley: We ought to be particularly careful to get roots in original eradication. Impossible to do good jobs late in season on areas with dense undergrowth.

Baker, C.E.: Do sprouts come from roots or crowns?

Littlefield: Experiments on gooseberries in New York show that when crown is removed little or no sprouting, while if crown is left, about 75% sprouting. Other species a different matter. Feels that most reports of root sprouting from gooseberries are mistaken identity.

REFINEMENTS IN THE USE OF A SIX-MAN CREW

By L. E. Newman and T. J. King

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Introduction

Looking back to the early days of Blister Rust Control and making a mental comparison of eradication methods then and now, one is impressed by the crude, although well intentioned, methods in vogue during those years. The authors of this paper would not however, appear to infer that present practices in eradication have reached such a high plane that no further improvements are possible. Rather it is the intention of this article to review, briefly, the developments in the eradication of ribes, and then to dwell at greater length upon a practice, - in operation in New Hampshire for some years,- but only recently brought to a much higher state of refinement.

Development of Eradication Methods

In the early days of crew eradication the number of men constituting the eradicating unit was six, one of whom was a foreman, or leader in charge. The more recent members of the Blister Rust organization may be amazed to learn that at one time the crew foreman worked in line with his unit. Why he did not precede the crew, following military tactics, and thus lead his aggregration of Ribes hounds against the hordes of elusive currant and gooseberry bushes, is something that historians of Rust Control have never seen fit to explain. Nevertheless, in the days of 1917, his position was in the line with his unit, but we are happy to be able to state, not for long.

Presently, experience, meager though it was, dictated that behind the line was the logical and proper position for the crew leader. Following this departure from old methods came another innovation, namely, the creation of an assistant foreman, or as he is often termed, the Headlinesman. He was placed directly in the middle of the line from which point of vantage he could easily guide the work of the unit. As implied by his title, the duty of such an individual, in addition to locating and pulling his share of Ribes, was to keep the crew line straight and to maintain fairly uniform spacing between each crew member. Furthermore, in this position he could guage the speed at which the crew, as a unit, might proceed and yet perform satisfactory work. The linesman also acted, in times of emergency, as the crew foreman.

With the advent of the Headlinesman in the crew organization and the conferring upon him of definite duties and authority it was found that the efficiency of the crew was much improved. Furthermore, it appeared that there was a great reduction in the amount of lost time, previously due to a natural tendency on the part of crew members to lag behind, get ahead or drift too far away from one another.

The marking of the outside limits of the crew strip also saw developments all the way from no marking at all up through blazing of trees and breaking of branches, to the present system, generally in practice in all of the states, of designating the crew strip limits by means of trail paper. Aside from preventing re-working of ground previously covered and also eliminating the chance of skipping new territory, the inauguration of "trail-making" developed more efficiency in crew operation.

What might be termed the next marked advancement in ribes eradication is seen in the originating of preliminary or advance scouting. It was proven, after several seasons' experience, that a properly trained man could eliminate from crew work many areas wholly Ribe free, or others containing too few to warrant their being destroyed by a full crew. By the application of this method costs were cut in two and the same sums allotted for the many eradication projects permitted the covering of much larger acreages.

The duties of this additional member consisted of examining, in advance of the crew, areas previously laid out by the Agent; marking such tracts as needed crew eradication; pulling scattered Ribes and in indicating to the crew foreman sections of blocks requiring the use of an organized unit of several men.

While the preliminary scout method proved generally satisfactory, there were certain weaknesses connected with its application. The original scheme of designating the outside limits of Ribes areas needing crew eradication called for the marking of them with white paint or through some other method. Where paint could not be used because of lack of contrast, trees were blazed lightly with a knife. The time honored Ribes mark, a circle with a cross in the center, located the entrance to these areas from the road and arrows painted on trees, boulders, etc., designated the direction from the nearest point on the highway to the area that was to be worked. While this method of marking areas for crew work was employed for several years, it was, in the light of field experience, never entirely satisfactory for the following reasons.

1. It took a great deal of the scout's valuable time to mark the Ribes area limits after he had decided upon them. In addition it required more time to mark directions for reaching the area from the main highway.

2. Scouts very often found it extremely difficult to properly mark the limits owing to a lack of trees, rocks, etc., upon which to place the proper symbols.

3. Even after these areas were so indicated the foreman quite often experienced difficulty in finding them, and it was necessary for the scout to make a special trip with the foreman in order to show the limits to him.

4. Once worked by the crew, there was no permanent record of Ribes locations as the paint marks and blazes ultimately disappeared.

5. This was a serious drawback when it came to the matter of re-eradication for it became necessary to re-scout the ground just as though it had never been previously worked.

6. When it came to checking areas neither the agent nor inspectors had anything very definite to use and it was necessary to carry on the checking in a very general way.

7. At the end of the field season all we had to show town officials and private owners for the monies we had expended was merely an ordinary town map of a size and so lacking in detail as to not permit recording much of the eradication data.

Hence, in view of the foregoing facts, a plan gradually materialized whereby it would be possible to eliminate much of the waste time on the part of the scout and crew and give something in the way of definite, permanent record for field, office and educational use. This development resulted in what we have termed the "scout map".

The Scout Map

Wherever possible, the U.S.G.S. maps are used as a base for the scout map. When these are not available in the territory that is being worked, the next best thing is used which is generally an old town map of varying scale and even of greater varying accuracy. Regardless of the scale of the base map the scout map is always enlarged to a scale of six inches to a mile. Having a standard scale for all such mapping is decidedly an aid in speeding up the work, for men quickly become accustomed to the plotting of details on uniform sized maps. The details which are plotted on the map consist of the following; runs, swamps, brooks, stonewalls, wire fences, woods, roads, trails, forest growths, outlines of areas of crew work, infections, etc.

The scout's method of procedure is as follows; The block, as it is generally understood, namely, an area bounded by roads, is the working unit. The scout takes with him into the field an outline of the block he is to work. His first step is to go around the area in order to get a comprehensive idea of the block as a whole. He notes on his map the location of all houses, runs, stonewalls and wire fences as they start from the road. The measurements are generally taken by pacing. Having traversed the outside limits of the block the scout then divides it into as many small units or plots as he can. This enables him to work the block more easily and thoroughly. As he covers each small unit or sub-plot, stonewalls, wire fences and the shape of the runs are plotted and through the process of tying in these local land marks he secures a complete, though perhaps somewhat rough picture of the area. This same process, applied in the several units or sub-plots, finally gives him a map of the entire block.

As he maps he scouts for ribes. He also makes a note on the map of the various types of forest growth. When he begins to locate areas which must be stripped by the crew he immediately starts tying in their limits with some natural boundary as for example, brooks, roads, or such artificial

boundaries as stonewalls, wire fences, trails and edges of open areas.

When he has completed his scouting and mapping in the field the maps are put in their final shape during evenings or perhaps rainy days; they are then turned over to the crew foreman. Before the foreman enters the block he discusses, the previous evening with the scout, all details pertinent to the successful eradication of areas laid out in advance. This practice makes doubly certain that there will be no lost time during the working day. The scout can often give the crew foreman valuable information as to the best method of working a Ribes area.

The scout map is not the result of a few moments thought, but rather has been brought to its present stage by persistent concentration and application of the foregoing principles over a period of several years. It came to light early in the season of 1923, in Merrimack County, and its entire development has taken place there under the direction of Agent King. Its use is now being extended to all sections of the State.

One important question in connection with its use, and which is probably uppermost in the minds of many who hear or read this paper, is 'How much does it cost to produce maps of this kind?' 'How much delay is occasioned by plotting the details in the field?'

The cost of producing the map is confined solely to the materials used, such as cross-section paper, pencils, pen and ink. As previously stated the scouts have produced the finished map during the evening hours or on rainy days.

With reference to the amount of time consumed in plotting details in the field the following comparison of the first days of Advance Scouting,- before mapping was in vogue,- and those of to-day may prove of interest and should settle the question of cost.

1919		1927	
Town	Cost of Scouting	Town	Cost of Scouting
Plainfield	$0.061	Webster	$0.071
Hampton	.062	Sunapee	.055

Thus, without increased cost a detailed record of an eradication project is secured and in addition, many other advantages which are given in the following paragraphs.

Value of Map

Encouragement to go ahead and develop the scout map has come mainly from the value it has been to the work as a whole. A few of the outstanding benefits derived are herewith given.

Time Saved

As a result of all crew work being definitely shown on the map and tied up to some natural or artificial boundary, thus making it easily located many crew hours formerly lost in hunting for the areas, were saved.

Through the making of the map, the scout is better able to determine at all times his whereabouts in the block, thus eliminating unnecessary steps and repetition of work.

It is of additional aid to the Agent in making the rounds of his crew, for with the aid of the scout map, he can easily locate a crew in the field.

Checking

For checking purposes the map has also demonstrated its value. With crew work plainly indicated it is very easy to place responsibility, should poor work be found. Checking with the map is performed much more intelligently as one has a picture of the plot to study before entering it.

Quality

The making of a map of this sort has, undoubtedly, increased the quality of the scout's work. As he is required to plot in so much interior detail, it is necessary that he cover the ground thoroughly. With the knowledge that his map is to be checked both by the Control Agent and the Inspector he is bound to take his job seriously and, as a consequence, be very painstaking in his work.

Supervision

The map is of great assistance to the Control Agent when it comes to planning crew procedure. This is extremely important especially so when the project has a definite expenditure limit.

Although the actual mapping of these areas is performed by another, nevertheless the supervision of such work and the continual referring to the blocks thus laid out naturally make the Agent much more familiar with his numerous control areas and serves to assist him in memorizing considerable information regarding the boundaries as well as what the interiors contain.

Educational

It has been found that as an educational feature, the scout map is worth all the effort and time necessary to produce it. Local residents, as a rule, know their town pretty well. They are, almost invariably, deeply impressed with the detail and accuracy of these maps. It seems to make two distinct impressions upon them. First, that we must be on the job to do work of this character; Secondly, that the work is thoroughly done.

It has been found that the making of these maps was instrumental in creating additional interest among the scouts and foremen.

Future Value

This map is invaluable in case it is impossible to complete during one year all the work laid out by the scout. With the system of shading in

completed crew areas and leaving blank those not finished, it is very easy to pick up the threads another year.

Perhaps the greatest future value of this system of mapping is seen in the use that can be made of it in re-eradication. With the location of former Ribes areas accurately plotted, it will be of material assistance when the ground is re-worked the second time as control measures will be speeded up and costs reduced.

Conclusion

The New Hampshire policy has held to the six man crew organization throughout the entire course of the work for it has been found that it best meets our general needs. It has, however, been kept flexible enough so that whenever occasion warranted the major organization could be split up into smaller units, generally two groups of three men each; one directed by the foreman, the other by the headlinesman. Such occasions would be the cleaning up of small Ribes areas, the working of stone walls, fences, roadsides, small runs, etc.

Where Ribes are abundant or where large areas contain bushes so distributed as to make it impracticable for the scout to work them, the six man crew organization is the ideal one. It is so well balanced, with the headlinesman located as he is, in the center of the line and two men flanking him right and left. The position of the foreman behind his crew is logical and has proved to be the proper place for him to direct and check Ribes eradication.

It is frankly admitted the maps as produced at present, by the advance scouts, have not been developed to the highest state of perfection, for each year sees some added improvement made. However, mindful as we are, of certain deficiencies, these maps have been the means of improving the quality of the work in general, and it is believed will continue to result in further improvements.

Discussion:

Questions asked by Messrs. Connor, Curtis, Rose, Baker, Richardson, Swain, Kennedy, Littlefield, and Riley, were answered by Mr. King, co-writer of the paper as presented by Mr. Newman. These inquiries dealt particularly with the detailed maps which are prepared by the New Hampshire scouts and brought out the point that the scouts are probably of a higher calibre than the average temporary field men employed in the other States. Questions relating to the head-linesman as employed on the New Hampshire crew, emphasized the point that the man holding this position may act as a foreman in an emergency. Mr. King also pointed out that while the six-man crew unit is a standard working crew, it is nevertheless sufficiently flexible so that the formation may be and is altered to handle particular situations.

EPIDEMIOLOGY OF WHITE PINE BLISTER RUST - 1927

By L. H. Pennington

During this, the third year, work has been done in the outlying sections of New York, New England, New Jersey and Pennsylvania to determine if possible the extent and prevalence of the rust. In the north and east the rust is found to be abundant and gaining ground everywhere that pine, particularly young trees, are to be found.

The conditions in northern New Hampshire and southwestern Maine illustrate very well the progress of the rust within the last ten years. North of Errol, New Hampshire conditions were found to be practically identical with those in eastern New York as at North Hudson and other places in the years 1917, 18, and 19. In one place where studies and counts were made the infections seem to have been not earlier than '18 and '19. All of the trees at the present time are more or less severely infected, with the greater number of infections ranging from 1923 to 25. One tree not over 8' in height had between 75 and 80 young cankers on its branches. The skunk currant was the only species of Ribes present in this plot as well as in some others where studies were made.

In other localities the rust seems to have made its first appearance in 1921 and '23.

It has already been noted that the oldest centers of infection were from Ribes imported in 1897 at Kittery Point or from pines imported in 1902 at Lindenville, Vt., Axton, N. Y. Ipswich, Mass., Lenox, Mass., Phoenicia, N.Y., and at Geneva, N.Y. This year it has become more apparent than ever that between the importations of 1902 and those of 1909 the rust spread by natural means over considerable areas. The old infection centers near Brunswick, East Parsonfield, Porter and other places in Maine, at Hingham, Plymouth, Swansea and other places in southeastern Massachusetts were very evidently started before 1909. It is also becoming increasingly evident that many other such centers as at Wilmington Notch, Schroon River, Douglas, Lewis in eastern New York were begun some time before the general introduction of infected pines in 1909.

It is a well known fact that infected pines introduced in 1909 were very widely distributed in New England and New York. Many of these pines were destroyed and the impression has been given that infection was entirely eradicated from the larger number of plantations made with this stock. Recent studies, however, indicate that in many of the instances the rust was not destroyed in the plantations before it had become established in the surrounding neighborhood.

There has been expressed an opinion that in certain sections where the rust is known to be present, very little recent infection has been found, particularly upon young trees. Accordingly examination was made of young reproduction at various places in eastern New York as at Lewis, Weavertown, North Hudson, as well as in the vicinity of Littleton, New Hampshire. In all of these places where young pines can be found in the

vicinity of wild Ribes, practically the same conditions were found to exist. Young infections of '23, '24, and '25 appeared to be equally abundant in all places. The most striking feature in such a study is the almost total absence of young reproduction in every locality where the rust is abundant and Ribes are fairly plentiful.

Very little rust upon the pine has ever been found in New Jersey or in Pennsylvania. At various times the belief has become current that white pine blister rust had entirely disappeared from these states. From time to time a little infection has been found upon black currants in New Jersey and a few years ago a little infected pine was found in the extreme northeastern part of Pennsylvania. The present season's work shows that either the rust has been present in these states for many years or that there was an unusually great spread of rust to cause infection during the past year.

As an illustration, the conditions near Winslow Junction and Blue Anchor in New Jersey, should be cited. In the plantation of black currants upon the grounds of Barrett & Price very heavy infection was found in August of this year, 504 of a total of about 900 bushes were infected. Red currants within 200 yards of this plantation were also infected to the extent of 50%. A few red currant bushes at Cedar Brook fully 2 miles from the black currant plantation and some cultivated gooseberry bushes not far from Bates Mill, 1½ miles in another direction were slightly infected. Pines were found at Winslow, Bates Mill and at Cedar Brook. It is difficult to determine whether this infection resulted from spores carried a long distance first to the black currants from which infection spread by uredospores or from infected pines in that vicinity. It is entirely possible that infection did spread from the heavily infected black currants either by wind-borne spores or by spores carried by the Japanese beetle, which was found to be abundant in that neighborhood and frequently upon the currant and gooseberry bushes. On the other hand a search showed that native white pines are growing within 1½ to 2 miles of these black currants in 3 or 4 different places. Near Winslow Junction there are several very large white pines and many younger trees ranging from 2 to 3' in height to well grown specimens 40 to 50' in height. These younger trees have been transplanted at several different places in the vicinity. No infections could be found upon these trees but past experience has shown that young cankers are very easily overlooked, especially if they happen to be upon higher branches.

The same conditions seem to hold in the counties of northeastern Pennsylvania. The results of scouting there seem to indicate that in certain localities the Ribes were much more abundantly infected than in other localities. Here again it is a question as to whether there has been infection by wind borne aeciospores or from infected pines in the immediate vicinity. It is entirely probable that the wide spread infection of this season resulted in both of these ways. McCubbins' observation upon the infected pine in Clarion County indicates that pine infection had occurred there as early as 1921. It is therefore very probable that infection of pine occurred in other places at least as early as it did at Clarion and at other places in the extreme Northeastern part of the State. In any event it means that there has been comparatively long distance spread of the rust at some time in the past.

All of our observations upon long distance spread of this and other rusts indicates that wind is the chief natural agent for the dispersal of the spores. It has already been shown that westerly winds prevail and that in any year it will be possible for spores to be carried very long distances to the East and the Northeast. It is very probable that the abundant and general infection in these directions thru New England, and Canada have resulted from the spores carried by the prevailing winds. A study of anamometer records of various places in New England and New York, show that during May the time of maximum spore production, there are periods of from one to several days duration when easterly winds prevail. For instance, during May of 1927 the Binghamton, N. Y. records show a total of 1264 miles of easterly wind. The larger part of this wind occurred during three separate periods in the month when there was from 1 to 300 miles of easterly wind in one period. In May of 1924 the Binghamton records show 1532 miles of easterly wind while the Syracuse records show 1880 miles of easterly wind. At both places the winds from the east were of long enough duration to have carried spores several hundred miles to the West and Southwest.

It is to be noted, also, that during both of these years rainy weather accompanied or followed very closely the periods of Easterly winds, thus making ideal infection conditions wherever spores might be carried. It has already been noted that heaviest infection of pine has resulted to the west of the infecting Ribes species and it seems altogether probable that while a greater number of spores may be carried by westerly winds to the East, moisture conditions are more favorable for the germination immediately following easterly winds which may have carried the spores to the West.

The infection data which have been collected in the past are not sufficient for all parts of the country to enable us to say with sufficient definiteness just what the periods of greatest pine infection have been. It is evident, however, that certain periods sometimes one year and sometimes extending over 2 or 3 years have been more favorable for general infection than others. While it is true that local conditions vary in different parts of the Northeast, there is a fair uniformity for the whole section. It has been commonly observed and our studies have confirmed the fact that the season of 1919 was exceptionally favorable for infection as shown by the great number of cankers which were found in the internodes of that year. It is equally evident that 1920 was very unfavorable for infection as shown by the small number of cankers in the internodes of that year. The infections of more recent origin are more readily determined and from these it seems that during the years '23, '24, '25, there has been a great deal of infection in the immediate vicinity of Ribes. It is difficult to say at present whether '24 or '25 were the best years for general infection. It seems at this time that both seasons were very favorable for pine infection. From a study of weather conditions it is very apparent that the seasons for general infection have been characterized by moist conditions over the entire summer season. For instance, the records show that in 1919 there was during May a great deal of easterly wind and an unusual amount of rainfall, both conditions favoring infection. June moisture conditions were favorable altho the precipitation was somewhat deficient. During July and August there was

an abundance of rain and fairly cool weather thruout the eastern states. On the other hand in 1920 which we have noted as a poor year for infection, May had less than half as much easterly wind and less than half its usual rainfall while during July and a part of August drought conditions prevailed. In 1924 which we have noted as a season very favorable for infection, May had an excess of precipitation and the temperature was notably low and while June was a little below in average precipitation, there was sufficient and during July and August the weather was notably cool and damp. This condition continued well into the month of September. In 1925 while there was less precipitation and easterly wind in May, the moisture for June, July and the first half of August was very abundant. As compared with these two years we note that conditions in 1921, '22, and '23 in general were unfavorable probably as a result of drought during the months of July and August.

It is to be hoped that our experiments at Warrensburg will throw much light upon exact conditions necessary for infection. The season seems to have been favorable both for the development of the rust and for the pines which were used in the experiment. Twenty small white pines have been exposed to infection, each lot for 1 day only and then transplanted to a place where they were not in danger of further infection. Weather conditions have been recorded very accurately by the use of thermohydrographs which were checked daily with the sling psychrometer. If this experiment can be continued for one or two years longer we should have a key which will serve very well to help us in understanding the ordinary meterological data.

So far as field observations upon Ribes infection and weather conditions for 1926 and 1927 indicate, the next two years should show a tremendous extension of the white pine blister rust thruout the northeastern states and probably the middle west.

The very wide spread and general infection of cultivated black currants during the past year should serve again to emphasize the extreme importance of this species in the dissemination of white pine blister rust over the country.

Discussion

Dr. McCubbin: Inquired as to whether there had been sufficient periods of easterly winds during 1927 to carry aeciospores from the infected regions in the northeast to Pennsylvania.

Dr. Pennington: Replied in the affirmative, stating that there had been sufficient periods of easterly winds to easily have carried aeciospores from infections in the Catskills entirely across the State of Pennsylvania. He also pointed out that the rising tide of infection in Wisconsin and Minnesota might have been the source of aeciospores causing Ribes infection in Michigan. Dr. Pennington further stated that every year there are sufficient movements of air currents for the carriage of aeciospores for

many miles and that the spread of the rust in Pennsylvania this year may be the result of long distance spread by aeciospores.

Mr. Hurford: Inquired as to the viability of sporidia produced on black currants as compared with sporidia produced on other Ribes.

Dr. Pennington: Replied that sporidia from telia on black currant leaves, are not necessarily more vicious nor are they longer lived, but they are produced in such greater quantity and over such long periods, that the likelihood of infection is, therefore, greater, just by the law of chance.

THE FEASIBILITY OF THE ERADICATION OF SKUNK CURRANTS

By C. C. Perry and Wm. Clave

In plain English, the title of this paper is - To What Extent is it Worth While to Attempt to Destroy Skunk Currants?

The skunk currant, Ribes glandulosum Grauer alias Ribes prostratum, is a trailing species of currant which grows most extensively in swamps or on rocky slopes. The main stem of the plant trails along the ground, takes root at frequent intervals, and produces upright branches along the stem. As a result of this trailing habit, one plant becomes a complicated net-work of runners and leaf-bearing stems. This trailing habit of the species makes the eradication of the plants a difficult task, for the reason that it is almost impossible to remove the plants intact and any pieces of stem that remain in the ground, soon develop into new and vigorous plants. Even in cases, where, from observations following crew work, it would seem that the most efficient work has been done, it may develop later, that many stems have been left in the ground, and in time the regrowth resulting, may support a greater leaf surface than that on the original plants. The species is also quite a prolific seeder and the working of an area during the fruiting season often results in the development of a veritable garden of seedlings.

The species, as described by Gray, has a distribution in "damp woods and rocks" habitats from Labrador to Athabasca south to northern New England, Michigan, Minnesota, and along the mountains to North Carolina. In Massachusetts, the species is fortunately local in its distribution, being general only in three towns (Royalston, Winchendon, Ashburnham) in northern Worcester County; scattering in its distribution in twelve other towns in the same locality (Athol, Phillipston, Templeton, Gardner, Westminster, Ashby, Fitchburg, Petersham, Hubbardston, Princeton, Barre, Dana) and found occasionally in isolated plots in 29 other towns (Berkshire County 16; Franklin 4; Hampshire 4; Hampden 1; Worcester 2; Middlesex 1; Plymouth 1. From this distribution, it is a fact, of course, that the problem as regards the effect of the species on the spread of the white pine blister rust, is a rather local one. The unfortunate part of the situation, however, is that this very same region in which skunk currants thrive, is one of the most important white pine producing sections of Massachusetts. It is in parts of this region (Winchendon) that it has been said, that forest conditions are on very nearly a sustained yield basis.

So much for the general condition - we have the Ribes and we have the pine; what about the blister rust?

Since 1920, more or less local Ribes eradication work has been in progress in the skunk currant region of the State, and literally millions of skunk currant plants have been pulled out. From casual observation, during the progress of this Ribes eradication work, it can be said that in this period of seven years the skunk currants have been generally infected with blister rust, and in many sections very heavily infected. With such conditions on the Ribes leaves, and with a situation factor; that is,

swampy conditions, - that should provide favorable conditions of humidity, it has been anticipated that great damage from the rust would result from the repeated infection of the Ribes. Some pine infection has developed, and in many places young infections can be located in considerable numbers; but in general, no very serious injury has been noted. This state of affairs, has naturally led to the inquiry as to the reason.

An analysis of the situation has led most directly to the conclusion that, apparently, the sporidia which develop on the leaves of the skunk currant, are effective at relatively short distance from the Ribes. If so, to what distance are these spores effective in doing serious damage to white pine?

For the purpose of ascertaining this fact, a beginning has been made in the selection of study plots in the skunk currant area, and an effort made to determine if possible the average distance of spread from the Ribes. In attempting to lay out the plots, considerable difficulty was encountered in finding suitable areas. In many cases, conditions seemed to be correct, but search revealed the presence of other species of Ribes within infecting distances. In other instances, suitable skunk currant plots were found, but no white pine beyond one or two hundred feet. This work, moreover, was not attempted until the close of the Ribes eradication field season this fall, and, therefore, the data which have been procured are rather meagre. I believe, however, it is a start in the right direction.

The field work has been done under the direction of Mr. Clave, Blister Rust Agent in the northern Worcester County district. Four plots in the town of Ashbrunham were established and the trees thereon carefully examined for infection. No data other than the presence or absence of infection were recorded, for the reason that time was limited and our particular interest was in distance of spread only.

There follows a brief description of each plot, together with a summary of the infection data by zones of 50 feet; 100 feet; 200 feet; 300 feet, and 400 feet from the skunk currants.

Description of Plots and Summary of Infection

The studies on the following plots were made during the months of October and November 1927. Two men were used in laying out the plots and examining the trees.

The first step was to stake out the limits of the Ribes area. These stakes were then joined by ordinary cotton string. The first fifty foot zone was then staked out and the stakes joined by string. Stakes were then set at 100-200-300-and 400 feet respectively. Strips ten feet in width were then laid out with string in each of the zones. The trees on each of the ten foot strips in one zone were examined at a time. If Ribes were found in the pine area the plot was immediately abandoned.

The description of the plots follows:

Plot #1

Bulkley Lot Block #38 Ashburnham, Mass.

Ribes glandulosum are growing on and around a stone wall. The area of the Ribes zone is about one hundred feet long and from twenty-five to fifty feet wide. This area was first found in 1923 at which time the Ribes were heavily infected. They have never been eradicated. The area is located in a belt of hardwood, the trees being medium thick and from three to ten inches D.B.H. Additional screening is given to the Ribes on the ground by a heavy growth of ferns. The Ribes on the wall are elevated about four feet from the ground. There is very little brush on the area. These same conditions of growth extend over the first fifty foot zone of the study plot, altho there are a few small pines in this zone.

The pine is growing in what was one time a mowing and the trees came in from seed from a nearby mature stand. There are a few scattered grey birch on the lot. The pines range in size from one to fifteen or twenty feet in height with the larger class in the majority. The Ribes are northeast of the pines which are growing on a twenty percent slope down to the Ribes.

The oldest infection found on the plot dated 1915.

Summary of Infection

Zone	No. Trees in Zone	No. Trees Diseased	% Trees Diseased
50'	8	5	62.5
100'	96	57	59.4
200'	407	178	43.7
300'	428	79	18.4
400'	488	37	7.5

Plot #2

Schoonmaker Lot Block #42 Ashburnham, Mass.

The Ribes were scattered in a swamp and concentrated on a run at the edge of the study plot. They were first found in 1923 and were heavily infected at that time. They were eradicated in 1924. Those on the run were growing in a fairly open space with a light ground cover of brush. Between the Ribes and the pine and in the fifty foot zone of the plot there was a fairly heavy growth of spruce and hemlock averaging eight inches D.B.H. The pine from there on was growing in the open and was even aged about sixteen years old, ranging in height from five to fifteen feet. A few scattered grey birch about the same height as the pine were mixed in the growth. The pines were growing on a level piece

of land about fifteen feet higher than the level of the Ribes. The pine was scuth of the Ribes. The oldest infection found on the plot dated 1917.

Summary of Infection

Zone	No. Trees in Zone	No. Trees Diseased	% Trees Diseased
50'	6	1	16.6
100'	71	7	9.8
200'	445	17	3.8
300'	444	4	.9
400'	348	2	.6

Plot #3

Hardy Lot Block #2 Ashburnham, Mass.

The Ribes were growing in a rocky run over an underground stream. When first found in 1923 they were heavily infected. They were eradicated in 1924. There were a few scattered mature hardwoods in the run, but no other growth. The plot was laid out in an old pasture on the east of the run. The pines were growing on a side hill with a twenty-five percent slope. The pines were fully in the open and rather scattered. Just over a stone wall north of the plot there is a plantation which was set with trees from a foreign nursery. It is believed that the infection was brought to this locality on these trees. The oldest infection on the plot dated 1916.

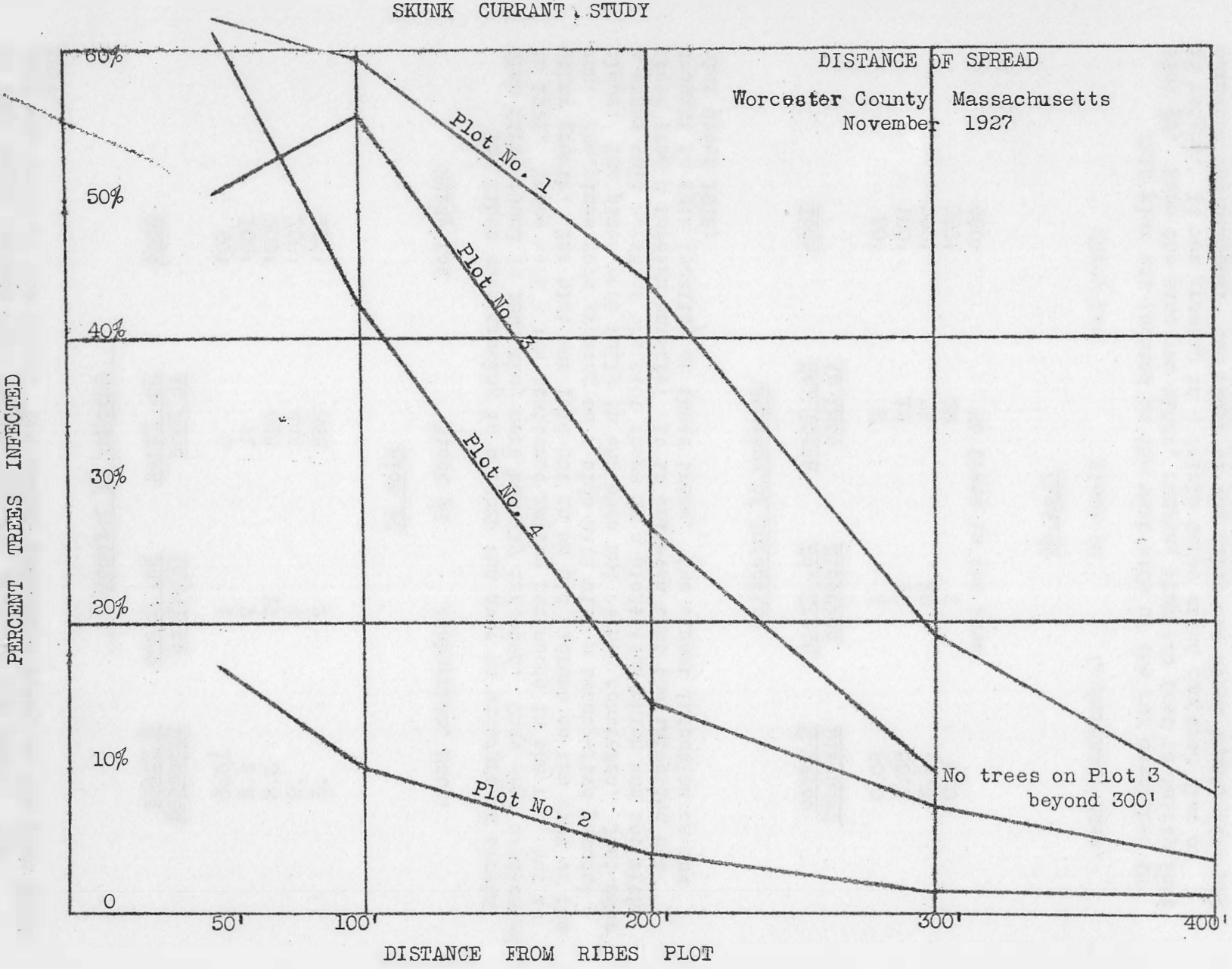
Summary of Infection

Zone	No. Trees in Zone	No. Trees Diseased	% Trees Diseased
50'	8	4	50.0
100'	18	10	55.5
200'	76	20	26.3
300'	22	2	9.0
400'	No trees in the zone		

Plot #4

Hardy Lot Block #2 Ashburnham, Mass.

This plot was located on the west side of the run described in Plot #3. Here the pine was older, ranging from two feet to thirty feet in height. It was growing in a fairly dense stand composed also of hardwood and hemlock. The slope to the Ribes was about twenty-five per cent. The oldest infection found dated 1914.


SKUNK CURRANT STUDY
DISTANCE OF SPREAD
Worcester County Massachusetts
November 1927
PERCENT TREES INFECTED
60%
50%
40%
30%
20%
10%
0
Plot No. 1
Plot No. 3
Plot No. 4
Plot No. 2
No trees on Plot 3
beyond 300'
50'
100'
200'
300'
400'
DISTANCE FROM RIBES PLOT

Summary of Infection

Zone	No. Trees in Zone	No. Trees Diseased	% Trees Diseased
50'	21	13	61.9
100'	19	8	42.1
200'	187	26	13.9
300'	190	13	6.8
400'	73	2	2.7

All the plots represent conditions most favorable for the spread of the rust from the Ribes and yet there certainly appears in each case to be a diminishing infecting power with an increase in distance from Ribes.

It is our further observation, that in the average skunk currant area, the pine that is in close proximity to the Ribes; that is, pine actually in the swamps or on the edge, is of a distinctly inferior type; inferior particularly, because the conditions that are favorable to the Ribes, are detrimental to the growth of the pines. In other words, the trees that are apparently most likely to be infected by the skunk currants are of little or no importance from a forestry standpoint.

If these facts are as they seem and can be substantiated by further study, are we justified in a continuing attempted complete eradication on a 900 foot protective zone basis. As has been pointed out, the eradication of skunk currants, is a most difficult process. This means costs are high; dollars rather than cents, and in many instances amounting to several dollars per acre.

Such initial costs are prohibitive for the average pine owner in Massachusetts. There are today in the skunk currant sections in Massachusetts, hundreds of acres where the owners simply can not afford to spend the money. These owners are perfectly willing cooperators, and are interested in the protection of white pine. The question is, can we offer control at less expense and still be on the safe side? In other words, is it not a fact that it is our task to effect the permanent control of blister rust as economically as possible, and not necessarily a task involving the complete elimination of Ribes in every pine area. Must we not consider the prospect of damage, the seriousness of the possible damage, and the pine values involved? Certainly, if it costs more to eradicate Ribes than there is pine value involved, we are not justified in recommending eradication. In such cases, may it not be much better to suggest the planting and encouragement of other tree species. The particular point, however, is that if we believe that the disease can be controlled by the selective eradication of Ribes, should we not determine the fact, substantiate it, and govern our recommendations accordingly.

To conclude then - we have a feeling in Massachusetts based to be sure largely upon casual observation, that it may be time to curtail, in the eradication of skunk currants. The eradication of the species costs

too much; the work involved is not initially efficient; the damage that is occurring is limited in its extent; and the pine value existant in close proximity to skunk currant habitats is relatively low. Further observations are, of course, imperative. Just how much of a protective zone will be needed if any, can only be determined by further study and even then will naturally vary with conditions.

It is urged that all agents who are working in skunk currant sections in the northeast, attempt to duplicate the field work herein described, in order that it may be determined definitely to what extent skunk currants are active agents in the spread of the rust. Conclusions can not be drawn from four small plots, altho the results obtained are certainly of interest.

Discussion:

Fivaz: How many years exposure?
Clave: Indefinite - oldest infection 1914.

King: Do skunk currants fruit heavily in Massachusetts?
Clave: Yes - in his district.

King: Quite unusual - very little fruiting in Merrimack County, N.H.

Riley: Are costs based on solid crew work?
Perry: Yes.

Newman: Have you considered chemical eradication?
Perry: Regan's experiments in Massachusetts tend to make them believe it is not practicable.

Newman: Tried chemicals on skunk currant in New Hampshire on several plots. Observations show they have been effective. Plan to continue experiment. A spray solution of sodium chlorate and calcium chloride was used; fish oil soap being added to the spray solution as a sticker.

Fivaz: Congratulates Perry and Clave on progress made in this study - hopes they will continue, and can fore-see very successful results if they do.

Conner: Majority of jobs in his district in Maine deal with skunk currants - take owners out and they pull bushes themselves. If they do not get all the bushes the first time, they go back and pull them the following spring.

Martin: Looked over several areas in Maine this past summer, and found that very good work had been done. Conditions somewhat different than in Massachusetts, where skunk currants occur in large mats in swamps and going is very difficult. What would work in Maine would not apply in Massachusetts under those conditions.

Rose: Asks Conner if owners will check over work second year on their own accord.

Conner: Usually interested enough to re-eradicate themselves.

Frost: Believes they have more skunk currants in Maine than all the other New England States put together.

Curtis: Have similar conditions in Oxford County, Maine, as in Massachusetts.

King: When we question advisability of skunk currant eradication, do we lose sight of the present crop of pine. From observations made in his district, convinced skunk currant eradication practicable and is amazed at remarks regarding impossibility of such eradication.

Filler: Perry's problem confined to three towns in northern Worcester County. His suggestions do not apply to skunk currants in remainder of State and other States.

Perry: Interested chiefly in skunk currants in swamps.

Frost: Areas in Lincoln County, Maine, where skunk currants have come in in great abundance in areas logged over. Infection on pine and Ribes very heavy; much of the pine reproduction being killed. In few years after slash dies, most of Ribes also disappear.

White: Was at a loss to determine why there was so much infection, in these areas mentioned by Frost, and so few Ribes. Ribes sprung up and grew rapidly for couple years, and when slash dies Ribes also are killed; probably due to lack of moisture.

Filler: Asks York and Pennington to tell of their experiences as regards skunk currants.

Pennington: Made studies in Maine and New Hampshire where rust has not been established so long. Observations show that young pines next to skunk currants were just as numerous and practically all infected, which bears out Clave's statement. Where reproduction is especially heavy, enough pine may escape infection to eventually shade out Ribes.

York: At North Conway, New Hampshire, observations made for five consecutive seasons in heavy growths of skunk currants showed bushes fruited heavily. Millions of seedlings came up and millions perished. First eradication was sufficient so that one man could, in a few hours, take out bushes which became established. Would not draw conclusions from this experience. Believes where tap root is taken out a second eradication with crew will not be necessary in most cases.

SHALL WE PUT THE SUBJECT OF BLISTER RUST AND ITS CONTROL IN THE SCHOOLS OF THE WHITE PINE GROWING STATES?

By R. G. Pierce

For several years the Office of Cereal Investigations of the United States Bureau of Plant Industry through its Section of Barberry Eradication, has been conducting educational work in the schools of the wheat-growing states. The success of this work, by an office conducting an eradication campaign similar in principle to blister rust control, indicates that we may be overlooking a good opportunity for constructive work. I do not mean that we are doing no work with the schools but our educational work with either grade schools, vocational schools, high schools, or academies and colleges is sporadic and hence weak.

In 1918, a blister rust survey was carried on through the schools in Michigan, Wisconsin, and Minnesota. In this work we followed the very successful plan used by Dr. McCubbin in Ontario. Again in 1922, Dr. D. V. Baxter sent 22,000 school teachers in Michigan a letter requesting specimens of Ribes leaves, and a card to note location of cultivated black currants. In these surveys we aimed at securing information.

In April 1927, Mr. W. O. Frost cooperated with other Maine Forestry officials in putting out an 8-page leaflet on American Forest Protection Week, which contained onepage on blister rust control; 7,000 copies of these went to school teachers. This was educational in nature. Dr. McCubbin's recent successful survey through the schools of Pennsylvania was presented to you this morning.

To return to the educational work of the Barberry Section: copies of their Lesson Plans have just been distributed to you. One of them is their socalled General Plan by Thompson and Fletcher, which can be used in any state in the grade schools. The others are specific state plans for North Dakota, and Montana. The North Dakota Plan follows this paper. These plans are for the purpose primarily of imparting information rather than securing tangible results on the spread of the disease, location of barberry bushes, etc., though thesedata have been received to some extent.

Thirty thousand or one-third of the grade schools in the 13 wheat-growing states are sent the Lesson Plan on "The Black Stem Rust and the Common Barberry" every year. In this way all the schools are reached in a 3-year period. The General Plan as you will see does not have answers accompanying the questions. More recent Lesson Plans such as those for North Dakota and Montana, with answers as well as questions, have a decided advantage over the old General Plan. Practical Exercises which have been included help clinch the subject in the minds of the teacher, besides carrying the subject home to the parents.

Not all of the wheat states are agreed as to the value of the long lesson plan. In Nebraska and three other states a single page general plan without answers is preferred to a 10 to 13 page plan. In other

words the kind of a lesson plan that suits the state authorities and the majority of teachers can be written for their use.

Shall the Office of Blister Rust Control and Cooperating state agencies conduct similar educational work in the white pine growing states? The Office of Cereal Investigation considers that the intangible value of the education of all the children in the wheat-growing states, concerning black stem rust and the barberry, is of such value as to warrant carrying on the work year after year. Several of the states have included the subject of barberry and the wheat rust in their curiculum for the grade schools. In Minnesota in the 7th grade there is a course on agriculture and a whole day is devoted to the barberry and the black stem rust of wheat. In Montana, the State Department of Education, which is preparing a nature study book, has included a complete lesson on barberry eradication. This book will go to all teachers of the 5th to 8th grades. Nebraska includes the subject in a bulletin of the State Department of Public Instruction. In other words, the State officials are well sold on the merits of teaching the subject.

Do the children help locate the barberry bushes? Yes, in every state statistics testify to the value of the educational work in this direction. Mr. Hutton, in Charge of Barberry Eradication, has just received data from North Dakota which emphasizes the value of the educational work with the school children in contrast to the value of the regular scouting work carried on by their agents. It might be said that North Dakota is a state in which it is most difficult to find barberries on account of their scarcity. In 1927 $15,000 was spent for survey and scouting in North Dakota, and approximately 500 barberries were found on 31 properties. During the summer 3805 schools in the state were sent Lesson Plans and material, and 15,000 children were reached. These children reported 6 properties on which 43 barberries were later found by the scouts. The school work was carried on at very much less cost than the survey work and yet it resulted in finding about 16% of the properties with barberry bushes. According to Mr. Hutton this is considered a real accomplishment.

From an educational point of view a similar Lesson Plan on the blister rust and its control ought to give good results in the white pine growing states. It is possible that the tangible results which can be secured within the next few years from such work will not be very great, but when this generation of school children becomes the pine owners of tomorrow, there should be very tangible results from the educational work which we are contemplating starting now.

Dr. C. B. Smith, in Charge of the Office of Cooperative Extension Work, stated in an address to the State Extension Leaders in 1925, that where there is a teaching problem that "logic points to a large amount of work with the youth--not just a few of the youth." Dr. Smith stated to me that experience also demonstrated the above.

If the idea of introducing a Lesson Plan in the schools on "Blister Rust and its Control", meets with your approval, the Washington Office will, with your assistance, be glad to formulate such Lesson Plans.

Discussion:

Upon the suggestion of Dr. Martin, the matter of the advisability of conducting blister rust educational work in the schools was referred to the State Leaders for determination at their next conference with their respective agents.

A LESSON PLAN BY WHICH NORTH DAKOTA TEACHERS MAY PRESENT THE SUBJECT "BLACK STEM RUST AND THE COMMON BARBERRY"

To the teachers of North Dakota:

The enclosed lesson plan for the teaching of the story of the common barberry and its relation to the spread of black stem rust of grains has my approval and endorsement.

Very sincerely yours,

Bertha R. Palmer, Superintendent,
Department of Public Instruction.

Furnished to the schools of North Dakota by the Office of Cereal Crops and Diseases, Bureau of Plant Industry, United States Department of Agriculture, in cooperation with the State Agricultural College, Fargo, North Dakota, the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minneapolis, Minnesota, and the State Department of Public Instruction, Bismarck, North Dakota.

The following lesson plan has as its basis a general lesson plan prepared by Donald G. Fletcher[1] and Noel F. Thompson[2]. It has been revised and adapted to the needs of North Dakota schools by George C. Mayous[3] and Edward M. Yocum[4] with the aid of the following State Officials and educators:

Miss Bertha R. Palmer, State Superintendent of Public Instruction in North Dakota.

President James A. McFarland of the Minot State Teachers College.

Miss Elsie Cook, critic of the Minot State Teachers College, and President of the North Dakota Parent-Teachers Association.

Mr. Carl E. Bublitz, Instructor in Agriculture, and other members of the staff in the training school of the Minot State Teachers College.

1. Secretary of the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minnespolis, Minnesota.
2. Associate Pathologist, Office of Cereal Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture.
3. Associate Pathologist in Charge of Barberry Eradication in North Dakota.
4. Agent, Office of Cereal Crops and Diseases, U. S. Department of Agriculture.

LESSON PLAN

A plan by which the teachers of North Dakota may be guided in presenting the essential facts concerning stem rust and its prevention through the eradication of the common barberry.

Teacher's Aim:

(1) To become familiar with the common barberry and its relation to black stem rust, and (2) to impart this information to the students.

Student's Aim:

(1) To learn the essential facts concerning the life history and the importance of black stem rust; (2) To learn to recognize the common barberry and distinguish it from other shrubs, including the Japanese barberry; (3) To learn to recognize the four stages of stem rust; and (4) To disseminate this information in the community.

Possible Correlations

The study of the common barberry may be advantageously included in the study of any or all of the following subjects: Botany, Biology, Agriculture, General Science, Nature study, Language, Arithmetic, Geography, and Spelling.

Definitions

Before beginning the study of black stem rust the following definitions should be mastered:

PARASITE: A living organism, either an animal or a plant, that lives on or in some other organism from which it derives its nourishment for the whole or a part of its existence. It produces no food of its own. A plant parasite, then, is a plant which steals its food from another living plant. Most such parasites are fungi, but not every fungus is a parasite as some are called saprophytes because they live on dead material.

FUNGUS: A fungus is a plant devoid of green coloring matter. Unlike green plants, it does not produce its own food materials, but obtains them from living or dead organic matter. It reproduces usually by means of spores. Examples of fungi: Toadstools, puffballs, bread molds, smuts, rusts, etc.

SPORE: A spore is a minute reproductive body or cell. It might very well be called the seed of a fungus.

HOST or HOST PLANT: Host plant is a term applied to the plant on or in which a parasite lives and from which it gets its food.

LIFE CYCLE: The life cycle of a plant or animal is the series of stages thru which it passes before completing its full development.

EXAMPLES: An example of this can be found in the four stages of the life cycle of the butterfly. First, the egg, then the worm, next, the pupa, and finally the butterfly. Black stem rust furnishes one of the best examples of the life cycle of a parasitic fungus.

Sources of Information

United States Department of Agriculture Farmers' Bulletin 1058, and Department Circulars 269 and 356. North Dakota Extension Circular No. 73. Pamphlets prepared by the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minneapolis, Minnesota, an agency cooperating with the United States Department of Agriculture and the States.

Suggestions to the Teacher

The loss of grain in the principal grain-growing areas of the United States from black stem rust has increased greatly in the past fifty years somewhat in proportion to the number of common barberry bushes. These bushes were introduced and planted as shrubbery and hedges but their seeds have been scattered by birds and cattle to waste lands and wooded areas. Almost every farmer who has raised grain has suffered losses from black stem rust. Effective control of this disease is of vital interest to American agriculture. It is of especial importance in North Dakota where so much spring wheat is grown.

Small grains are attacked also by several other plant diseases which in some sections cause severe damage. The diseases most easily confused with stem rust are the leaf rusts of cereals, including crown rust of oats. Where the leaf rusts occur, pupils should be taught to distinguish between the leaf rusts and black stem rust, which is the only grain rust spread by the common barberry.

Read the bulletins carefully. Familiarize yourself with the answers to the questions. Allow the pupils to study the material, the bulletins, and the charts, before beginning any discussion on the subject. Divide the study questions into several recitation periods as thought best. Emphasize the identification of the common barberry bush. Have the pupils bring to school samples of any bushes they may believe to be the common barberry and, if necessary, send the samples to the Biology Department, State Agricultural College, Fargo, North Dakota, for identification. Encourage the pupils to ask their parents about black stem rust and the damage it does. Explain carefully the relation of the common barberry to this rust. Point out clearly that the destruction of every common barberry is absolutely necessary for the successful control of black stem rust. Encourage the pupils to look for barberry bushes. When one is found, let all the neighbors see it and then report its location to the Barberry Eradication Office, State Agricultural College, Fargo, North Dakota.

A. Relation of Common Barberry to Black Stem Rust

Question 1. What is black stem rust?

Answer - Black stem rust is a fungous parasite which attacks wheat, barley, oats, rye and many of the tame and wild grasses.

Reference - N. Dak. Extension Circular No. 73, p. 5; U. S. Department of Agriculture Farmers' Bulletin No. 1058, pp. 5 & 6; Department Circular 269, p. 12; Department Circular 356, p. 1.

Q. 2. Explain why and how the kernels are shriveled when rust attacks the plant severely.

A. - The rust attacks the grain plant and robs it of the food which is intended for the development of the kernels. As a result these kernels are under-nourished, and shriveled from lack of food.

Ref. - N. Dak. Extension Circular 73, p.8.

Q. 3. Name the four stages in the life cycle of stem rust.

A. - The four stages of black stem rust are:

(1) The yellow cluster-cup or spring-spore stage. Develops only on the barberry bush. Produces yellow spores.

(2) The red or summer-spore stage. Develops only on grains and grasses. Its reddish-brown spores spread to other grains and grasses and produce a second crop. In like manner, successive crops of summer spores develop about every ten days throughout the summer.

(3) The black or winter-spore stage. Develops only on grains and grasses. Follows the summer stage, producing its black spores in the red-spore pustules or in new pustules.

(4) The colorless-spore stage. Produced in the early spring by germinating black spores. These colorless spores infect only the barberry, producing the cluster-cup stage.

Ref. - N.Dak. Extension Circular 73, p. 5; Farmers' Bulletin 1058, pp. 5 & 6; Department Circular 69, p. 12; Department Circular 356, p. 2.

Q. 4. Why will the eradication of the common barberry in North Dakota and adjacent States tend to stop destructive stem-rust epidemics?

A. - Without the common barberry, the black-spore stage which lives over the winter can not infect grains and grasses. The red stage, which can infect grain directly, does not live over winter in these States.

Ref. - N.Dak. Extension Circular 73, p. 6.

Q. 5. What effect does hot, wet weather have on black stem rust?

A. - Hot, wet weather speeds up the production of rust spores which enables the rust to spread rapidly.

Ref. - N. Dak. Extension Circular 73, p. 7.

Q. 6. What color is the rust produced on a grain plant after it becomes infected by the spores from a rusted barberry bush?

A. - The first stage of the rust which appears on grain plants is brick red.

Ref. - N. Dak. Extension Circular 73, p. 7.

Q. 7. How is rust spread from the barberry to grains and grasses?

A. - The rust is spread from the barberry to grains and grasses by tiny spores carried by the wind. These spores are so small that they can not be seen with the naked eye.

Ref. - N. Dak. Extension Circular 73, p. 7.

Q. 8. Can this red rust on the grain plants infect other grain plants? Does stem rust produce one crop or more than one crop of red spores during the summer? How often may a new crop of red spores be produced if weather conditions are favorable?

A. - Yes, the red rust on the grain plants can infect other grain plants by means of the red spores. Stem rust may produce a number of crops of red spores during the summer, the number depending on weather conditions. Under favorable weather conditions a new crop of red spores may be produced every seven to ten days. Each new spore may infect another plant and thus aid in the spread of rust.

Ref. - N. Dak. Extension Circular 73, pp. 6 & 7.

Q. 9. Can black spores directly infect grains and grasses?

A. - No, black spores can not directly infect grains, they are the resting spores by which the rust survives the winter.

Ref. - N. Dak. Extension Circular 73, pp. 6 & 16; Farmers' Bulletin 1058, p. 6.

Q. 10. Can the black spores directly infect the barberry?

A. - No, the black spores germinate and produce the colorless spores which infect the common barberry.

Ref. - Department Circular 356, p. 2.

Q. 11. What are the only plants that can be infected by the colorless spores of black stem rust?

A. - Only some plants belonging to the Barberry family.

Ref. - N. Dak. Extension Circular 73, p. 6; Farmers' Bulletin 1058, pp. 5 & 6.

Q. 12. Do all kinds of barberries spread black stem rust?

A. - No. The Japanese barberry does not spread stem rust.

Ref. - N. Dak. Extension Circular 73, p. 5.

Q. 13. What is one of the best methods of controlling black stem rust?

A. - The eradication of the common barberry is one of the best methods of controlling stem rust in both the northern United States and many foreign countries because the red spores do not live through the winter in the northern States, and because the black spores and the colorless spores are harmless without the barberry.

Ref. - N. Dak. Extension Circular 73, p. 8; Farmers' Bulletin 1058, pp. 5, 6, & 7; Department Circular 269.

Q. 14. Would the eradication of all the common barberries on one farm protect the grain on that farm from black stem rust?

A. - No; because spores of stem rust may be blown from barberries or rusted grain on other farms. Rust spores, being very small, may be carried by the slightest breeze.

Ref. - General information from all bulletins.

Q. 15. Could the barberries in the neighboring States produce rust which might spread to the grain in this State?

A. - Yes, under favorable weather conditions it is very likely that spores from barberry bushes in one State could be blown into another State and cause rust infections.

Q. 16. What have other countries done to control black stem rust?

A. - Several foreign countries, notably Denmark, have passed laws compelling the destruction of the common barberry. In each of these countries serious damage from black stem rust no longer occurs.

B. Losses Caused by Black Stem Rust

Q. 1. Why is the market value of shriveled grain greatly reduced? (Compare a sample of rust-shriveled grain with a sample of plump grain which has not been damaged by rust.)

A. - Shriveled grain is not as heavy as the plump grain and its value is also reduced by the fact that it is not well suited for milling purposes.

Go to your local elevator and inquire the market price of wheat weighing 58 pounds to the bushel and wheat weighing 48 pounds to the bushel. (Wheat that has been attacked by rust very often weighs ten or more pounds less than wheat which has been free from rust and other diseases.)

Q. 2. What is the average annual stem-rust loss in the United States? In North Dakota?

A. - The average stem-rust loss to small grains in the United States is estimated at nearly 50,000,000 bushels annually for the 12-year period 1915 to 1926, inclusive. In North Dakota alone in the same period the average annual loss is estimated at about 19,000,000 bushels.

Ref. - N. Dak. Extension Circular 73, p. 16.

Q. 3. Has barberry eradication reduced stem-rust losses in North Dakota?

A. - Yes. Although the campaign to remove all of the barberries is far from completed, stem-rust epidemics have become less severe and the general annual occurrence of stem rust has been considerably later.

C. Identification of Common Barberry

Q. 1. Describe the appearance of the common barberry bush as to shape and size.

A. - The common barberry is an erect shrub of graceful habit. It ranges from a seedling bush of a few inches to a mature shrub of possibly twelve or more feet. The color of the leaves is a dull green. There also is a variety of the common barberry which has purple leaves.

Ref. - N. Dak. Extension Circular 73, pp. 3 and 6; Department Circular 356, p. 2.

Q. 2. Describe the outer bark, inner bark, leaves, thorns, flowers, and berries of the common barberry.

A. - The outer bark is grayish in color and is furrowed, the inner bark a bright yellow. The leaves normally are produced in clusters. They always have bristle-toothed edges. The three-pointed thorns occur at the base of the leaf clusters. The flowers are yellow. The berries are green in the summer and red in the fall and winter. They are produced in drooping bunches like currants.

Ref. - N. Dak. Extension Circular 73, pp. 4 and 6; Department Circular 356, p. 2.

Q. 3. Compare the bark, branches, leaves, flower clusters and berries of the common barberry with those of the Japanese or harmless barberry.

A. - The bark of the common barberry is gray and furrowed in comparison with the reddish-brown, smooth bark of the Japanese barberry. The branches of the common barberry grow erect but those of the Japanese barberry are spreading, rarely attaining a height of over four feet. The leaves of the common barberry have bristle-toothed edges; those of the Japanese barberry have smooth edges. The thorns of the Japanese barberry usually occur singly at the base of the leaves. The flower clusters and the berries of the common barberry grow in bunches like currants while on the Japanese barberry the flowers and berries appear singly or in pairs.

Ref. - N. Dak. Extension Circular 73, pp. 4 and 6; Department Circular 356, p. 3.

D. Other Methods of Black Stem Rust Control

Q. 1. What effect does the early planting of spring grain have on the control of stem rust?

A. - The early planting of spring grain may help it to mature earlier and thus escape the late epidemics of stem rust.

Q. 2. How can the farmer help the grain to get a good start so that it can ripen before the rust damages it?

A. - Proper crop rotation, proper fertilizers, thorough preparation of the seed bed, early seeding and the use of early and best adapted varieties of grain will aid in the production of a sturdy plant which is less likely to be attacked by rust than weaker plants.

Q. 3. Are there varieties of spring wheat that are more resistant to stem rust than others? What are they?

A. - Most of the varieties of red hard spring common wheat are more susceptible to black stem rust than are the durum wheats. Of the durums, Monad and Nodak are more resistant than Kubanka and Arnautka, the standard varieties. Of the common varieties, Kota and Ceres are more resistant to stem rust than Marquis, the most widely grown variety of spring wheat.

E. The Introduction and Distribution of the Common Barberry in the United States.

Q. 1. Is the common barberry native to the United States?

A. - No.

Ref. - N. Dak. Extension Circular 73, p. 3.

Q. 2. Where did the common barberry come from and how has it been distributed throughout the country?

A. - The common barberry is thought to be native to the mountains of middle and western Asia where it was used by man as a medicinal plant. As civilization advanced, the bush was carried either by root or seed wherever the new settlers went. In addition to the use of its leaves and bark for medicinal purposes, the berries have been used in making jellies and wines, and the yellow roots were made into dyes. Later the shrub was used as a hedge fence and for ornamental purposes. For this latter use it was commercialized by nursery companies and sold throughout the United States.

Ref. - N. Dak. Extension Circular 73, p. 3.

Q. 3. Are there any harmful barberries native to North America?

A. - Yes, two species of harmful barberry have been found to be native to North America. Neither of these species is native to North Dakota. One of the native species, called Berberis canadensis, has been found in Illinois, Indiana, and Kentucky and in the Allegheney Mountains. The second species, Berberis fendleri, has been found in Colorado and other Rocky Mountain States.

Q. 4. By what means are the seeds of the common barberry scattered from a seed-bearing bush?

A. - The barberry seeds are scattered principally by birds, but also by cattle and other animals, by man, and by running water.

Ref. - N. Dak. Extension Circular 73, p. 11.

Q. 5. How long do barberry seeds lie in or on the ground before germinating? How does this increase the difficulty of barberry eradication?

A. - Barberry seeds have been known to lie in or on the ground for as long as six years before germinating. For this reason several reinspections of properties on which bushes have been destroyed are necessary.

Ref. - N. Dak. Extension Circular 73, p. 12.

F. The Eradication of the Common Barberry

Q. 1. Does North Dakota have a law condemning the common barberry?

A. - Yes. This law was passed in 1917. Similar laws are in force in each of the other States in the barberry eradication area.

Ref. - N. Dak. Extension Circular 73, p. 3.

Q. 2. How are common barberry bushes killed?

A. - Common barberry bushes may be killed by digging or by the application of salt or kerosene to the base of the bushes.

Ref. - N. Dak. Extension Circular 73, pp. 14 and 15; Department Circular 356, p. 3.

Q. 3. Why is digging often unsatisfactory?

A. - Digging is unsatisfactory because a small root fragment left in the ground may produce sprouts which will spread stem rust.

Ref. - N. Dak. Extension Circular 73, pp. 14 and 15; Department Circular 356, p. 3.

Q. 4. Why is it necessary to revisit properties even after the original barberry bushes have been removed?

A. - Because the seeds may lie in or on the ground for a period of several years before germinating and also because bushes that have been dug very often produce sprouts.

Ref. - N. Dak. Extension Circular 73, p. 14.

Q. 5. Why must care be exercised in placing salt or kerosene on barberry bushes growing in a lawn?

A. - Salt or kerosene placed upon barberry bushes growing in a lawn or hedge also may kill valuable shrubbery or other vegetation within an area of five or six feet. For this reason care must be used in the application of these two chemicals.

Ref. - N. Dak. Extension Circular 73, p. 14; Department Circular 356, p. 4.

Q. 6. If you find a bush which you think is common barberry, to whom would you send a sample for definite identification?

A. - Samples of bushes suspected to be common barberry will be identified free of charge if they are mailed to the Biology Department, State College Station, Fargo, North Dakota.

Q. 7. If you find a bush which you think is common barberry, should you destroy it?

A. - No one should destroy any shrubbery until the sample of it has been properly identified. In this way valuable hedges and shrubbery will not be destroyed by mistake.

PRACTICAL EXERCISES

Ask the pupils to bring in some of the black stage of the rust which is present on the stubble of most grain fields. Examine the rusted straw under a hand lens or microscope. Notice how the rust has broken through the straw. Scrape some of the black spores from the stem into a drop of water on a glass slide. Place a cover glass on the material and examine under the microscope. Note that the black spores are two-celled. Note their comparatively thick walls. Each cell of a black spore may germinate in the spring and produce the tiny colorless spores which infect the common barberry.

If the red or summer stage of the rust is available, prepare a microscope slide of it. Compare the size, shape and color of these spores with the black spores. Note that the red spores are only one-celled and are oval in shape. Note, too, that the walls on the red spores are thin. It is for this reason that these spores soon dry out or are killed quickly by cold weather.

Have the pupils draw a twig of the common barberry showing the chief characteristics by which the bush may be identified.

Examine a group of cluster cups on a barberry leaf. An average-sized cluster-cup contains from 8,000 to 15,000 spores, so that a moderately-infected common barberry bush six feet high may produce hundreds of millions of black stem-rust spores.

CORRELATIONS

Language

Write a letter asking for bulletins on barberry eradication. Write a letter to some farmer telling him about the relation of the common barberry bush to black stem rust. Have the pupils write sentences containing the words suggested for a spelling lesson.

Arithmetic

The following figures were obtained by actual counts made on a common barberry bush of medium size:

Total number of leaves	35,000
Percentage of leaves showing rust	80
Average number of rust clusters on each infected leaf	8
Average number of cups in each cluster	36
Average number of spores in one cup of a cluster	11,500

Q. 1. How many rusted leaves would there be on the average-sized bush?
A. - 28,000.

Q. 2. How many clusters of cluster-cups would there be on the average-sized bush?
A. - 224,000.

Q. 3. How many cluster-cups would there be on each leaf?
A. - 288.

Q. 4. How many cluster-cups would there be on the entire bush?
A.- 8,064,000.

Q. 5. How many spores would be produced on the entire bush?
A. - 92,736,000,000.

Q. 6. If the wind distributed these spores so that one fell on each square inch of land surface, how many acres would the spores from this bush cover?
A. - 14,784 acres.

Q. 7. How many square miles is this?
A. - 23 square miles.

Q. 8. How many barberry bushes would it take to produce one spore for every square inch of land surface in your county?

Q. 9. What is the damage in dollars that has been traced to rust spread from a single common barberry?
A. - The damage traceable to a single bush is very hard to determine because of the long distance which spores may be blown. However, damage to the extent of $50,000 was definitely traced to a single common barberry in Indiana.

Combined with the following facts, some amazing results may be obtained. A single red rust spot on a grain plant may contain one hundred thousand spores, each capable of causing more rust on the same

or other grain plants. From the time infection occurs until a new crop of spores is formed, about ten days have elapsed. Each of the new spores may repeat the process. In ordinary seasons at least four to six crops of red spores may be produced between the time the barberry begins spreading rust and the time of harvest. Fortunately, many of the spores produced fail to survive.

Geography

Study the area in which the barberry eradication campaign is being carried on. Where is most of our spring wheat grown? Winter wheat? Give reasons for clearing this area of all common barberry bushes.

Spelling

barberry	destructive	cooperation	chemical	germinating
eradication	disease	campaign	kerosene	common
destroys	epidemic	yield	average	European
stem rust	damage	weather	production	grain
spore	agriculture	reduced	escaped	sprouts
Japanese	cluster-cup	spine	prevention	resistant
grain	wheat		distribution	bristle-toothed

WHITE PINE BLISTER RUST IN NEW JERSEY

By E. G. Rex

White pine, as a tree for reforestation purposes, finds little encouragement in New Jersey. However, this tree as well as the Himalayan pine have been extensively planted as ornamentals. The timber land of the northern third of the state, no doubt, was well covered with white pine. This region has been lumbered in the recent past with the result that hardwoods are now appearing in much greater abundance than the white pine. The severity of weevil injury further hinders the pine growth.

Blister rust was first found in New Jersey in 1911, on pines growing on the Newark Watershed at Charlotteburg. Since then infection has been found somewhere in the state, every year with the exception of 1912,1914,1915 and 1923. Infection this year, which appears to be true for the other north Middle Atlantic States, was more generally prevalent than ever before. The scouting work for the year 1927 conducted by the State Department of Agriculture in cooperation with the U. S. Bureau of Plant Industry showed the disease present at 21 different localities, in 7 counties but only on Ribes. There has not been a reported pine infection since 1918.

The eradication of wild Ribes in New Jersey is not a serious problem. These plants occur in the northern part of the state, but their location to valuable pine stands is such that their removal does not seem urgent.

The ornamental white pines are concentrated in the Red Bank and the Morristown sections. In the 1927 cooperative scouting work, 87,915 pines were examined. The largest known ornamental white pine holding is 25,000 trees growing on a Lakewood estate. Two other white pine stands, though not growing as ornamental primarily, are: one at Bridgeton, 30 acres solidly planted 16-year old white pines another at Gibbstown, where 65,000 12-year old white pines are scattered over 320 acres. The Himalayan pine, although having a few representatives in the Orange-Montclair section, is most prominent in the Moorestown-Haddonfield section, about 12 miles southeast of Philadelphia. Several nurserymen are attempting, with varying degrees of success to grow Swiss Stone Pine seedlings. Probably the most noteworthy specimens of this species is growing on the State Nursery property at Washington's Crossing.

Discussion

Clark: Is spraying effective in preventing Ribes infection?

Rex: I know of one instance where no infection appeared on black currants which had been sprayed several times with Pyrox.

A DISCUSSION ON THE MOST EFFICIENT ERADICATION CREW

By J. E. Riley, Jr.

I am glad to note that the topic for discussion is the Most Efficient Eradication Crew, not The Most Efficient Size of Eradication Crew. It gives us a broader field for discussion and one I believe more likely to produce concrete results. I suspect one reason for assigning me this topic was to get a report on the Canaan experiment and so let me start the hour with a report on the present status of the study.

I must admit a considerable lack of accomplishment due, in part at least, to inexperience in handling statistical data, but largely to the presence of many conflicting influences to which it is impossible to assign accurate values. Because of the presence of these unknown influences whatever conclusions may be reached must be regarded as tentative only or at least as showing direction of influence rather than as accurate measurements.

Let me mention some of the factors that may influence cost and eradication efficiency and to which consideration must be given if reliable information as to the influence of crew size on efficiency is to be obtained. These possible influences are:

1. Number, size and species of Ribes present on area.
2. Location of Ribes from standpoint of accessibility.
3. Variations in topographic difficulties.
4. Ground cover - kind, amount and distribution of vegetation.
5. Physical obstructions other than ground cover.
6. Atmospheric conditions - temperature, humidity and degree of light.
7. Physical and mental condition of the crew members.

It may seem like "hair splitting" to consider the last two influences but it is reasonable to suppose that much more work will be accomplished on a clear, cool day with a crew in good health and spirits than when the reverse conditions prevail. Add to these seven influences considerable leeway in a foreman's judgement as to the maximum speed in which the crew can do efficient eradication work and put on top of that the probable sources of error in gathering data and you will have an idea of the possibilities of getting conclusive evidence on the comparative efficiency of various size crews from this one experiment. Repeat this experiment several times and then if the conclusions are identical we can legitimately say that our conclusions are correct.

This somewhat pessimistic introduction is made to give an indication of the intricacy of the problem and the need of more preliminary knowledge of many factors that probably influence time efficiency and which if not allowed for may overshadow whatever influence mere crew size has on efficiency. Now with all this out of my system, let me proceed to analyze our

data for the purpose of eliminating as far as possible complicating influences and to show the trend if not the intensity of influence of crew size on efficiency.

First, let us consider Cost Efficiency. The basis for measuring cost efficiency is the length of time it takes to eradicate a given area. In Chart I it is mathematically demonstrated that if a crew had no other duties than walking over the area and if there was no lost time, the cost per acre covered would vary inversely with the size of crew used. In other words the larger the crew the smaller the per acre cost. This is entirely due to the smaller proportion of foreman's time in the larger crews. Because of the smaller proportion of foreman's time, both the area per man covered and the cost per man hour is lessened in the larger crews.

But the crew has another duty to perform, namely, to hunt for and destroy Ribes. Incidental to this work lies possibilities of lost time, some of which are not apparent. The lost time turning around at the end of a strip is easily recognized, but lost time due to an unnecessarily wide linesman's strip or to variations in width of crew members strips are not so apparent. Lost time per acre covered in either class may increase or decrease with the variations in crew size and may reverse the tendency shown in Chart #1.

The first job therefore in our study is to analyze the total time spent, separating it into component parts and studying each part separately with a view to isolating lost time and ascertaining its relation to crews of different sizes.

Chart #2 is an attempt to analyze total time consumed in crew eradication as shown by the Canaan experiment. The relation of these parts to each other and to the whole is illustrated graphically. The pink portion represents the number of man minutes used by the foreman directing and checking the eradication work on the strips. It accounts for 13.5% of the total time consumed. The blue portion represents the time used by the foreman in turning the crews around at the end of the strips. It represents 1.2% of the total time, but of course it would be less on longer plots because there would be less strips per acre covered and consequently less turning. The orange shows the time used by the crews in turning at the end of the strips. It represents 7.4% of the total time and, like the foreman's time turning the crew, it would be less on longer areas. Green depicts the recorded time lost by the crews from such causes as uneven distribution of Ribes, failure to use a pick, obstruction of passage, uneven distribution of ground cover, distraction of attention, lost line or delayed linesman. (By the way, 81.1% of all lost time recorded in this experiment is attributed to uneven distribution of Ribes, causing an uneven distribution of work and resulting in idleness or unproductive effort.) Total lost time recorded represents only 1.3% of the total time and together with the two previous causes is relatively insignificant. However, we must not lose sight of the fact that lost time recorded is the obvious lost time. Just how much lost time is camouflaged in the work of the crew remains yet to be seen. The chief parts of time to be further studied in this experiment is the time of the foreman directing the crew eradication and the time used by the crew in lining and eradicating.

The latter is the fifth portion from the bottom and represents 76.6% of the total time consumed by the entire crew. It is probable that these relationships are approximately correct in spite of the fact that we have not eliminated complicating factors of number of Ribes present, variations in topographic difficulties, etc. Some work has been done in studying the time spent by the crew lining and eradicating and of the foreman's time, and some results have been obtained, but the study is a long way from complete.

However, for the sake of today's discussion, I have attempted to draw some tentative conclusions which are also illustrated in Chart #2. The upper line (in Section C) represents the relation between crew size and the time consumed, disregarding any complicating influences that may exist. These unknown influences presumably are responsible for the fluctuations in the curve. It apparently indicates an increase in time used with an increase in crew size. But the increase may be more apparent than real. This is shown in Section B by plotting the number of Ribes found, against the size crew. You will note a striking similarity in the two curves. This similarity shows that the number of Ribes pulled exerts an influence on time consumed and seems to explain all the fluctuations in the primary curve. The question is how much influence does it exert? If we subtract this influence from our primary curve, the resultant curve (Section A of Chart #2) will more nearly reflect the true influence of crew size on time used than the primary curve. This curve (1) represents the apparent influence of the number of men in line to time used with the big complicating factor of Number of Ribes Pulled removed, but still containing minor complicating influences. It seems to me that it is safe to argue from this curve that there is some actual increase in time consumed with increased size of crew but it is very small and overshadowed by other influences. Just what other influences or combination of influences are responsible for the irregularities, I do not know but hope to find out in the course of time. This apparent relationship if true, and if the fluctuations in the curve are rounded off represent a difference of 5.5¢ per acre in cost between a 3 and a 10 man crew with a gradual rise in cost from the 3 man to the 10 man crew. Thus our study would seem to indicate that the larger crew is less cost-efficient than the samller one. Again, let me remind you that this is a tentative conclusion that may or may not be borne out by further study.

Another tentative conclusion that might be drawn is that the size crew is relatively unimportant as far as influencing cost efficiency. We have a more fertile field in the ferreting out of some of the unapparent lost time. Whatever causes are responsible for lost time are not apparently increased or decreased much by variation in crew size.

(1) Footnote:- The method used in subtracting one curve from the other is as follows:

1. Each plotted point on both curves was replotted as a per cent of the total range of the curve below the highest point. Thus the curves were put on the same unit basis.
2. These new points of the top curve were subtracted from the corresponding new points of the bottom curve.
3. The resulting points were plotted not as per cents of total range but as man minutes below the highest point in the range of the first curve. If my method is right, the resultant curve represents the difference between the two original curves.

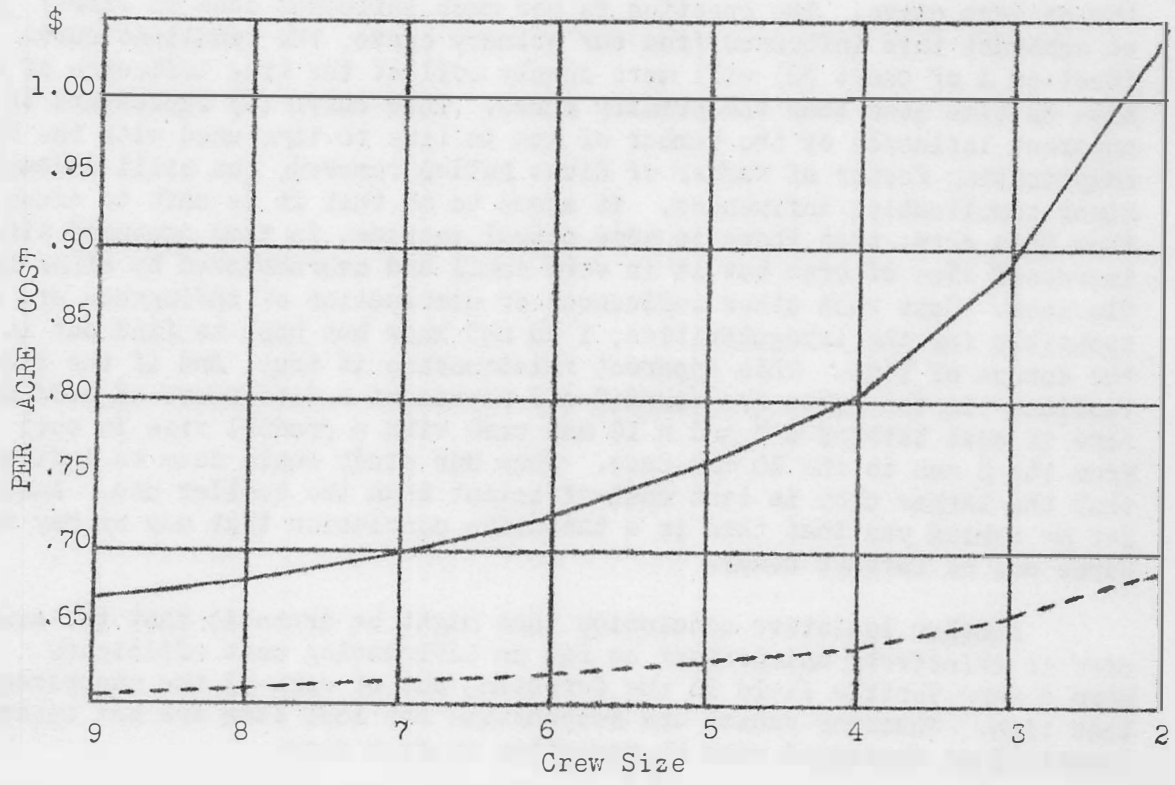
CHART I

CURVE SHOWING RELATIVE COST OF DIFFERENT SIZE CREWS
WHOSE SOLE DUTY IS TO WALK OVER THE AREAS

Spacing in Line 8 ft.
The Crew Foreman Receives 62.5¢ per Hour
Laborers Receive 37.5¢ per Hour

Walking Rate 1 mi. per Hour

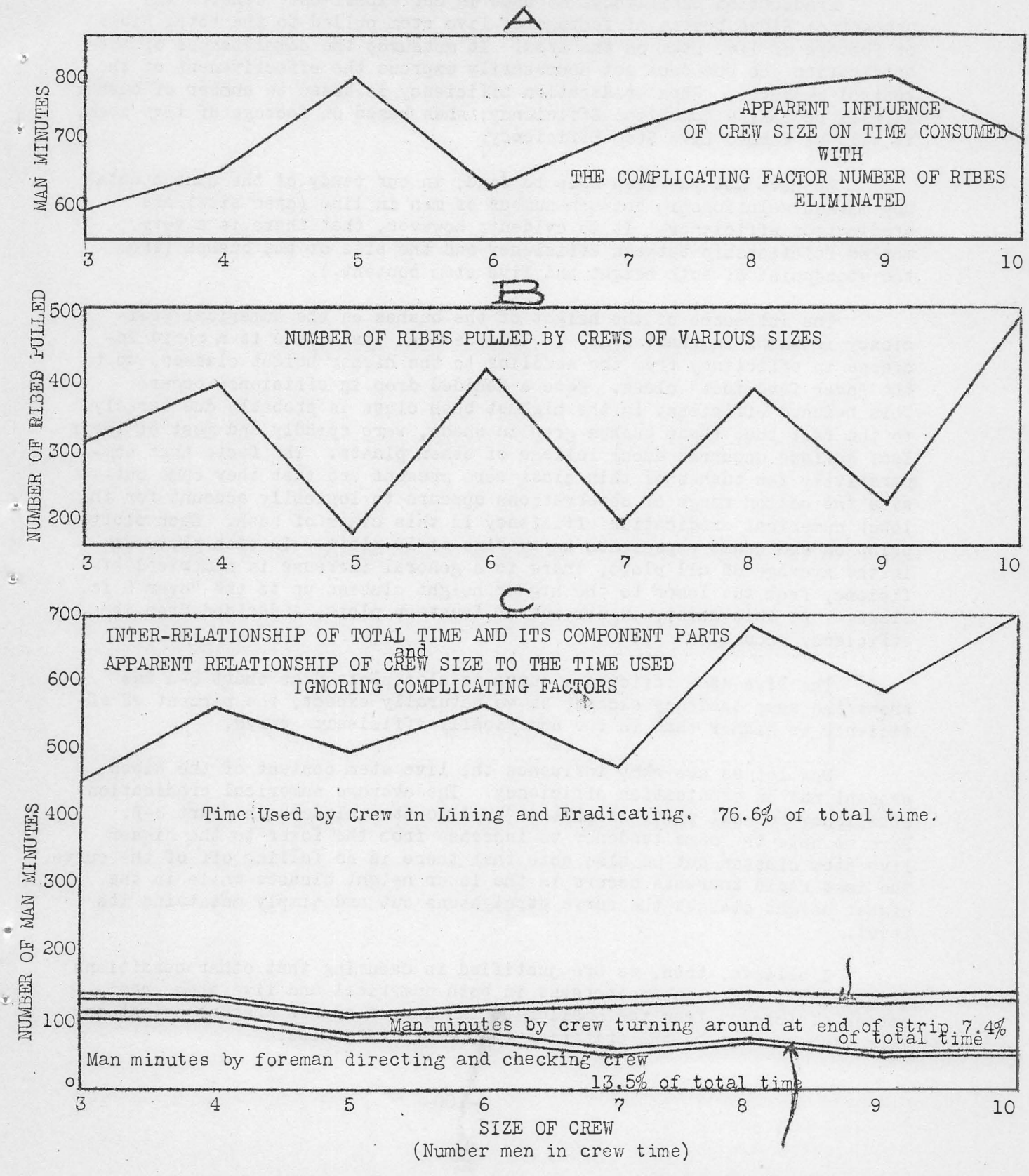
——————— EACH LINESMAN COVERS 4 FT. STRIP
— — — — — EACH LINESMAN COVERS 8 FT. STRIP



J.E.R. 11/27/27

CHART 3

ANALYSIS OF TIME USED BY CREWS OF DIFFERENT
SIZES IN ERADICATING RIBES
ON AREAS OF EQUAL SIZE AND OF
SIMILAR SHAPE



J.E.R. 11/16/27

ERADICATION EFFICIENCY

Eradication efficiency, as used in our experiment, denotes the percent of Ribes bushes of footage of live stem pulled to the total Ribes or footage of live stem on the area. It measures the completeness of the eradication job but does not necessarily express the effectiveness of the control measures. When eradication efficiency is based on number of bushes it will be called Numerical Efficiency; when based on footage of live stem, it will be termed Live Stem Efficiency.

We have not yet been able to find, in our study of the Canaan data, any marked relationship between number of men in line (crew size) and eradication efficiency. It is evident, however, that there is a very marked relationship between efficiency and the size of the bushes (from the standpoint of both height and live stem content.).

The influence of the height of the bushes on the Numerical Efficiency is shown in chart 3-A. It will be seen that there is a rapid increase in efficiency from the seedling to the higher height classes, up to the "over five foot" class. Here a decided drop in efficiency occurs. This reduced efficiency in the highest bush class is probably due largely to the fact that these bushes grew in shade, were spindly and most of their leaf surface occurred among foliage of other plants. The facts that comparatively few bushes of this class were present and that they came outside the common range of observations appears to logically account for the lower numerical eradication efficiency in this class of bush. Each plotted point on the chart represents an average of 14 plots. In each plot, as in the average of all plots, there is a general increase in numerical efficiency from the lower to the higher height classes up to the "over 5 ft. class." At this point, in six out of fourteen plots, a decided drop in efficiency occurs.

The live stem efficiency curve is also plotted as chart 3-A and shows the same tendency except, as we naturally expect, the percent of efficiency is higher than in the numerically efficiency curve.

Now let us see what influence the live stem content of the Ribes present has on eradication efficiency. The average numerical eradication efficiency for all plots is plotted by live stem classes in chart 3-B. Here we note the same tendency to increase from the lower to the higher live stem classes but we also note that there is no falling off of the curve. The most rapid increase occurs in the lower height classes while in the higher height classes the curve straightens out and simply maintains its level.

I believe, then, we are justified in assuming that other conditions being equal, there is an increase in both numerical and live stem eradication efficiency from the smaller to the larger bushes whether height or live stem content be the criterian for determining size.

CHART 3-A

INFLUENCE OF RIBES HEIGHT
on
ERADICATION EFFICIENCY
(As determined by one check)

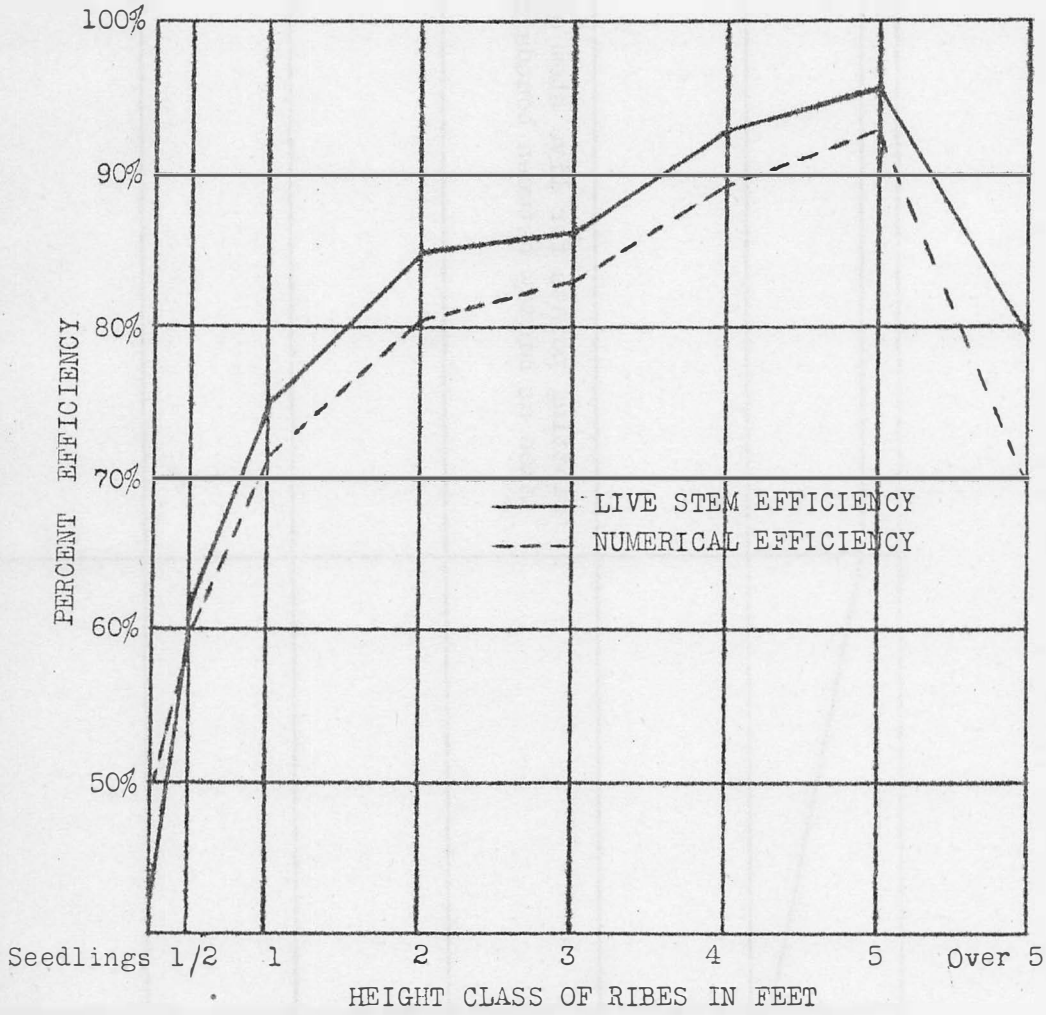
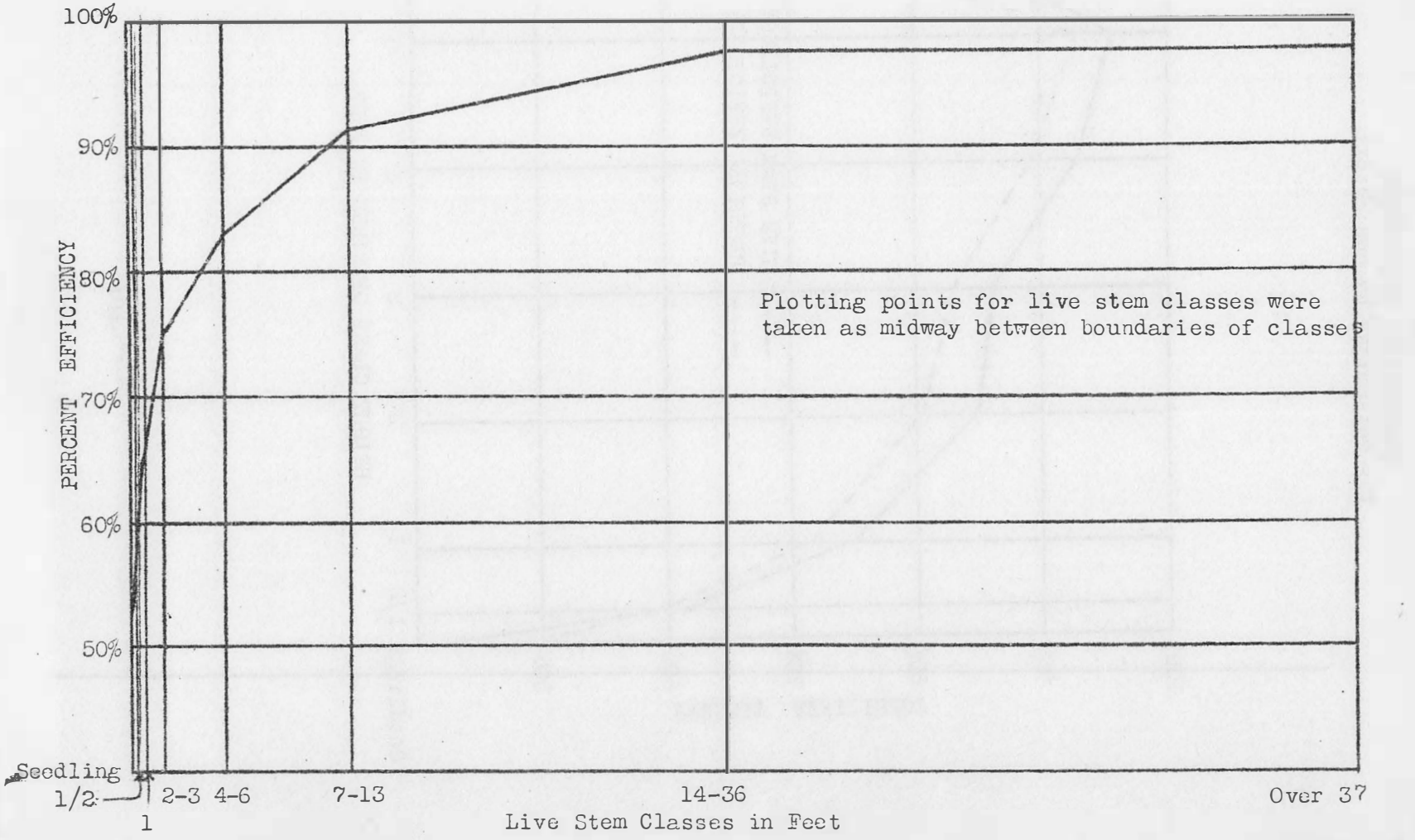


CHART 3-B

INFLUENCE OF LIVE STEM CONTENT OF RIBES
on
ERADICATION EFFICIENCY
(As determined by one check)



J.E.R. 11/26/27

Now if I may briefly summarize the points made in this paper it will leave with you an idea of the status of the Canaan Experiment and may suggest material for discussion.

In any study of this nature there are bound to be complicating factors which must be eliminated or the data must be so "weighted" as to equalize their influence on the factors to be studied. There are numerous influences of this nature in our experiment and to gather the data necessary for the elimination of some of these influences would be prohibited from the standpoint of time and cost. We can only hope to minimize them. Therefore whatever conclusions our data seem to justify must be regarded only as a contribution to a sum total to be obtained from numerous studies of this nature.

It appears at the present stage of our study that the cost efficiency is influenced only slightly by the number of men in line, although there is a slight tendency toward a decrease in cost efficiency from the smaller to larger crews. If such is the case it is due to the greater amount of lost time in the larger crews from such causes as turning crew at end of strips, distractions of attention and to other non-apparent sources that haven't yet been brought to light but which undoubtedly exist camouflaged in the operation of lining and eradicating.

No pronounced correlation has yet been observed between eradication efficiency and crew size.

It is quite apparent that both the height and live stem content of the Ribes on the area greatly influences the eradication efficiency. Our data shows conclusively that much higher eradication efficient work will be done in eradicating tall and large bushes than in eradicating low and small bushes.

Discussion

Fivaz: Brings out point that leaf-bearing stem and live stem are different. Live stem used as basis in studies - is amount of actual stem of any plant which is alive.

King: Asks what system was used in turning men at end of strips.

Riley: Pivoted - holding same positions.

King: Describes system used in his district which reduces lost time to a minimum.

Riley: Lost time in turning insignificant on larger areas.

Rose: What method was used for laying line?

Riley: Paper trail.

Snell: In 1917, in Wisconsin, found that large crew worked to better advantage than small one.

Doore: Use 2 or 3 man crew on most of jobs in his district, and seem to get results. Believes small crew more effective under conditions in his district.

Frost: 91 percent of all the work done in Maine during 1927 performed by 2 or 3 man crews.

Conner: 2 or 3 man crew much more efficient than larger crew on some jobs.

Kennedy: Type of work to be done governs more the size of the crew to be used. Have training school for foremen in New York. New men for each job responsible for much lost time.

Riley: Basis of efficiency is amount of leaf bearing stem left per acre, not percent of bushes pulled.

Holden: Use all sizes of crews (1-5 men) in Vermont; usually 4 men and foreman on large jobs.

Clark: Conditions on individual jobs regulate size of crew.

Bradder: Believes extra man behind crew has great possibilities.

STUDIES OF BLISTER RUST DAMAGE IN THE ADIRONDACKS

By Walter H. Snell

Previous work in New York resulted in data on mortality of pines from blister rust, and was in terms of percent of dead and doomed trees. The class called doomed was set down on the basis of certain death to come, as prognosticated on the basis of other studies. This past summer an attempt was made to get the damage in terms of the future merchantable stand, either in percent of trees lost from the mature potential stand, or wherever possible, the loss of board feet, or dollars and cents, if necessary. The problem is a complex one, with many factors involved, and the past summer's work was an attempt to get the procedure on a firm basis. Two of the New York Conservation Department experimental plots served the purpose for working out preliminary details of the procedure.

One of these plots, the Dannemora plantation, at an altitude of 2100 feet, offers certain advantages. Of about 1700 trees, nearly 53% were infected, 3% were dead, and 48% doomed to death, making the mortality 51%. A map was made of the plantation with every tree accurately placed. The first step in estimating the damage was to work out on the basis of the map, a combination of trees that would give the largest number and the best spacing of those trees with regard to future lumber production, without interferance by blister rust, and then an estimate was made of the amount of lumber that these trees would produce under those conditions, checking the estimates from the map against an estimate in the field. It was found that the best the original stand could make under the conditions was 500 to 550 trees on the two acres with a production of about 55,000 board feet.

The next step was to determine the best that the stand could do in the way of number of trees properly spaced for the production of the best lumber, figuring on the elimination of dead and doomed trees, account being taken of the trees that would serve as trainers as well as those serving for lumber production. This second estimate, considering the dead and doomed trees, showed that about 370 trees properly spaced would be left. The production of these trees on two acres would certainly be no more than 40,000 board feet, and of poorer quality.

The damage here, then, in number of trees is about 25% as compared with the mortality of 51%. The loss in board feet is easily 15,000, more than 25%, without making accurate estimates of the difference due to fewer trees per acre, and the loss of quality for the same reason.

The other study mentioned, contributed little to the damage discussion, because the damage is going to be so great. A rechecking of the Kelm Mountain area of two acres showed only 90% of the 1100 trees to be infected as compared with 97% at the first working. This 7% of "recoveries" - trees in which the cankers had been killed by shading out - provided much interest. Whereas it was estimated formerly that 80% of these trees would be dead in 15 years, it is found that 40% are dead inside of

3 years, and the mortality is now figured as 87%. In other words, the stand is completely ruined. The stand was thick enough in part of it to produce good lumber trees, and in the thinner portion, as regards pine, there were enough hard woods of similar height to cause the pines to produce a fair amount of lumber. It was estimated that this lot should have produced 50,000 or 60,000 board feet on the two acres, but as a result of blister rust and shading out, only 100 trees are to be left on the two acres - hardly enough to bother about. The damage, then, is nearly total.

THE EUROPEAN LARCH CANKER

By Perley Spaulding

Last spring this disease was discovered to be present in the eastern part of Massachusetts in several towns, but especially in Hamilton and Ipswich. It was found especially on European larch which was imported about twenty years ago from Scotland. Nearly all of the trees were found infected in the worst areas which were examined. Since that time scouting has been done to learn the distribution of the disease. Douglas fir in the vicinity of the worst infections on European larch was found to be heavily infected also, the cankers resembling those of the larch. This is far more serious to us than the disease on the imported larch, as it is a dangerous threat to our very extensive stands of fir in the Northwest. There is in the stands of the native larch of the Northeast a fungus, which appears to be identical with the foreign parasitic canker, but which is saprophytic in action. Whether this is really the same as the foreign fungus remains to be determined. Both fungi have tiny, cup-shaped, white bodies with short stems; the inside of the cup is a bright yellow or orange color. When dry, the edges of the cup roll inward and the diameter of the whole fruiting body is much reduced. When wet, the edges unroll and the cup becomes saucer shaped, and much larger in diameter. Hence it is much the best time to look for it in wet weather or just after rain. It is found on dead twigs as well as well as on the cankers; in fact one should look first on dead twigs for it, as a rule. The blister rust agents have an excellent opportunity to find and examine plantings of larch, and should lose no chance to do so. If anything suspicious is found send it in for positive identification, with a slip of paper bearing your name, post office address, the kind of tree that the specimens come from, date, and locality collected. You can help considerably by so doing.

Discussion: Upon the suggestion of Mr. Pierce, Dr. Spaulding urged the agents to send in for determination any suspicious specimens of disease found on larch.

Resolutions Adopted By The 13th Annual Blister Rust Control Conference

Resolved that the Secretary of this meeting be instructed to send to Dr. Taylor a letter expressing the appreciation of the Blister Rust Control Agents and Leaders for his favorable decision in extending authority to the Blister Rust Agents to attend the 13th Annual Blister Rust Conference.

Resolved that the Blister Rust Agents express their appreciation of the privilege of attending this Conference to Mr. Detwiler, Dr. Martin, and Mr. Filler by a rising vote of thanks.

Resolved that this Conference as a whole express its regret at the inability of Dr. Metcalf to attend, and that the Secretary of the meeting be instructed to send a copy of this resolution to him.

Resolved that the sympathies of this Conference are hereby extended to Mr. P. H. Merrill, of Vermont, for the great loss he personally sustained as a result of the recent flood.

Resolved that this Conference express its thanks in writing to the Boston Office of the United States Civil Service Commission for the privilege of the use of this wonderful room for the Conference, and the Secretary be so instructed.

Resolved that in the opinion of this Conference the investigative papers presented here are very important contributions to the Blister Rust Control program, and it is our hope that such investigative work will be vigorously continued.

Resolved that messages of sympathy and encouragement in the form of telegrams be sent to Agent F. J. Baker and former Agent O. C. Anderson, who are absent on account of sickness, and that the Secretary be so instructed.

Resolved that the Members of this Conference extend their sympathies to the people of Vermont through their State Forester, Mr. R. M. Ross, for the sufferings they have recently experienced in the great flood crisis, and that the Secretary be instructed to send Mr. Ross a copy of this resolution.

Resolved that this Conference and the entire Blister Rust Control Organization has sustained irreparable loss in the death of C. R. Pettis of the New York State Conservation Department, who was with us at our last Conference in Albany and whose interest in and efforts for the advancement of Blister Rust Control from the time of the discovery of the disease in this country in 1909 until his death in 1927, were unremitting and invaluable.

H. L. McIntyre,
Chairman, Resolutions Committee.

LETTER OF DR. C. A. SCHENCK

In the following letter Dr. Schenck comments on three addresses, relative to white pine, given before the 24th Meeting of the Deutschen Forstverein held at Frankfurt, Germany, August 24, 1927. We are indebted to Doctor Schenck for the receipt of a separate giving these addresses in German. These have been translated and appear on pages 109 to 115.

DARMSTADT
Nov. 6th 1927.

S. B. Detwiler, Esq.,
Bureau of Plant Industry,
Washington, D. C.

Dear Mr. Detwiler:

Pardon me when your letter of the 2nd August has failed to receive an earlier reply: Tubeuf did not have any separate prints of his address; and it will not be before summer 1928 that the official report is published.

The speakers at the forestry meet--attended by over 1200 greencoats--were

1. Dr. Wappes, who has sponsored the introduction of White Pine for the last 30 years; when he was a youngster, he had charge of the oldest stand of White Pine in Central Europe, at Trippstadt, which was raised from seeds brought back by some of the Hessians!

2. Vanselow, Professor in Giessen, who treats the white pine silviculturally as a means to an end: It is the best means for the extirpation of weeds. It is characteristic that no one in Germany knows anything of the TIMBER QUALITIES of White pine---

3. Baron von Tubeuf, who is opposed to White pine because of its many enemies; his remonstrations made, in 1909, he says, have failed to be heeded; White pine was and is raised in Germany on a large scale. Tubeuf gives next an idea of the home surroundings (Bio-Cenosis) of White Pine, refers to the damages by Agaricus melleus, and then --- has nothing to say but what we all know: EXCEPTING the statement that the blister rust was observed as early as 1865 in BALTIMORE*, MD. That is news to me, and possibly to you.

Tubeuf recommends experiments with Pinus Peuce and with Pinus montana arborea and (heaven knows why?) with Pinus resinosa, these species to take the place of White pine: All of which seems to me to be perfectly ridiculous. Peuce isn't much bigger than is cembra: Montana arborea is a swamp-inmate; resinosa isn't 5-needled and is no better than is silvestris, anyhow.

*This information was later proved to be incorrect, Dr. Tubeuf referring to the Baltic region rather than to Baltimore, Md. (See also footnote on page 114).

THE ECONOMIC IMPORTANCE AND SILVICULTURAL TREATMENT OF WHITE PINE (P. STROBUS)*

Summary of Three Addresses Given Before the 24th Meeting of the German Forestry Association (Deutschen Forstvereins) at Frankfurt a.M. Aug. 24, 1927.

Address by Dr. Wappes, Ministerial-Director.

1. While we have known the white pine since 1705, its cultivation in forests has been of some importance only since the last decades of the 18th century.

2. Its extensive use about 1880 is laid to the propaganda for the introduction of exotic trees, particularly as their silvicultural value for soil improvement, shelterwoods and nurse trees was recognized.

3. Observations have been made of its great susceptibility to the shoestring or honey fungus, (Armillaria mellea), between 30 and 40 years, also of the decrease in its cultivation at many places directly attributed to the devastating work of the blister rust (Cronartium ribicola).

4. Statistics recently gathered by the German Forestry Association showed a very unequal distribution of white pine in Germany; that is, in the government-owned and commercial forests, including pure stands and mixed stands where white pine occurs in large proportion (the latter being reduced to pure stand).

The acreage in white pine is as follows:-

Over 90 years of age about 7 hectares (equivalent to about 17 acres).
Between 61 and 90 years about 143 hectares (353 acres).
Between 31 and 60 years about 1464 hectares (3617 acres).
Below 31 years about 3500 hectares (8648 acres).
The tree occurs as a small per cent of the forest on about 18,600 hectares (45,962 acres).

In Prussia the foremost districts having white pine are Stettin, Breslau, Luneberg, Cassel and Munster; in Bavaria, the Palatinate and Lower Franconia, though proportionately Hesse has the largest stands. Hesse and the Palatinate, each have a larger area in pure and mixed white pine than the whole of Prussia. The figures for Austria are approximately 100 hectares (247 acres). For Switzerland about 223 hectares (551 acres), while in Alsace Lorraine and German Sudeterland the white pine is found in a few districts in fairly large tracts.

5. The present stands and mixed growth are in general not of noteworthy influence on the income of the forest. Of greater importance is the fact that even at an early age its silvicultural effects have begun. The most important result of its past cultivation seems to be that, over quite considerable tracts either singly or in groups, this introduced tree through its early reproductive capacity will increase more strongly in the future.

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*Grateful acknowledgement is made to Dr. C.A. Schenck and Dr. C. von Tubeuf for the above papers.

6. Since there is no question about the silvicultural value of the white pine it is the blister rust problem which will be decisive as to its further and increased cultivation.

7. Its introduction and adaptability for cultivation in Germany is looked upon favorably.

The writer (Dr. Wappes) has this conception of the matter:

a. That exotic trees should be imported into Germany, whose forests are poor in tree species, but that these trees should be tested carefully with regard to their requirements, yield and susceptibility to pests.

b. That such introduction is especially appropriate when an increase in the volume and value of the trees, or a good silvicultural effect can be secured.

c. That the frequently mentioned objections of an esthetic nature are of even less importance than the fears concerning unknown dangers or later difficulties as to sale.

8. The question cannot at present be settled satisfactorily, although it is sufficiently important to be studied carefully. About all that seems necessary is that the collection of data, on the volume and value of white pine in pure stands, and especially in mixture with other trees, be undertaken through the experiment stations.

Address by Dr. Karl Vanselow of Giessen.

I The question of the importance of white pine as a forest tree in central Europe is essentially a part of the problem of cultivation of foreign species of trees. In order to answer this question we must consider it from the standpoint of plant geography, (deductive method) and then from the results of former experiments in cultivation (the inductive method).

II 1) The possible knowledge secured by the first method, concerning the adaptability of white pine (Pinus strobus) to cultivation and the desirability of its being cultivated is generally indicated by the plant physiologic conditions of climate and soil according to Mayr in "The Gist of Certain Forest Principles" (Hauptsache sicheres forstliches Allgemeingut). We are uncertain, however, about the equally important facts of varieties or races.

2) On the other hand the possibility of information on the basis of experiments - the plantations of white pine in central Europe - seem to be exhausted, no other foreign species having been distributed in so many places under such diverse conditions for such a long period, (already more than 100 years). Moreover, the results of cultivation are plainly to be seen from the replies to questionnaires sent out by the German forest association in the year 1926; these questionnaires cover all classes of woodland holdings in Germany, Austria and Switzerland, and the more than 2000 replies represent undoubtedly the most comprehensive statistical material that has ever been gathered with reference to a forest problem. Consequently it may be asserted that:

III 1) The home of the white pine is in eastern North America. The climate is a moderate continental climate with transition to a maritime: 42 to 50 degrees Fahr. yearly average temperature; 59 to 66 degrees F. average temperature during the four months of vegetation, May to August; 65-80 per cent relative humidity and 9.5 to 23 inches precipitation during that time; the season free from frost is between May and September, the lowest temperature being 5 to -40 degrees F. Mayr ranks the white pine with beeches and firs (as to climatic requirements); it is therefore adapted to cultivation in most of the districts in Germany - perhaps excepting eastern Prussia and the higher mountains. The optimum for beech coincides probably with that of white pine.

The success of white pine in its native home and in artificial plantations is attained within wide boundaries. This leads us to suppose that there are climatologic races, which must be considered when we want to grow it in Europe; we have not done that so far. Possibly this is the cause of many negative results.

The characteristic soil of the white pine is, in its home, fresh or even damp, slightly sandy clay, best when close to ground water. In dry sand and decidedly poor soils there are no white pine stands. Besides these site qualifications, there have been disclosed from the best of the plantation records the silvicultural and physiological requirements of white pine as follows:

2 a) The white pine is a tree requiring half shade; it stands between Norway spruce and Scotch pine; this is shown by its habit of reproduction, spacing in the stand and its suppression in the underwood.

b) Specifically, the individual tree needs much room for its growth; the decrease with age in the number of trees in the stand occurs much faster than with all other central European trees.

c) Its frost hardiness is indisputable. It is only in places with very short growing season that the shoots frequently fail to lignify and thus succumb to the winter frost.

d) The rapidity of growth may be stated relatively: in its own optimum region - central and west Germany - at the age of 30 years it is taller than all the other trees except the Douglas fir; this superiority in growth is of shorter duration in the optimum of Scotch pine in the north German lowlands, and also in the optimum of Norway spruce. In production of a large volume of wood white pine is unexcelled, except by the Douglas fir.

e) The relatively dense-foliaged crown, and the abundand long needles which fall off after 2-3 years and slowly decompose, enable the white pine as no other tree species to keep the weeds down, and as a consequence to protect and improve the soil.

f) It is only in the very damp climate of northwest Germany that the white pine forms raw humus; it tends to do so in humid regions and even in old pine stands in arid regions.

g) It withstands damage by smoke better than all the indigenous conifers.

h) The white pine is tap-rooted striking deep into the soil; it is wind-firm, but it does not stand continuous strong winds (on the coast).

i) It bears seed early (at the age of 20 years), and afterwards often and abundantly; it reproduces itself naturally.

k) The results of cultivation confirm the view that the white pine is very adaptive as to soil, far surpassing the Scotch pine in this respect.

l) It is sensitive to drought.

m) It is not subject to damage by snow.

n) These advantages of white pine are, however, weakened by its susceptibility to the blister rust (Cronartium ribicola) and to the shoestring or honey fungus, Armillaria mellea (Agaricus melleus); of these the former kills sometimes 90 per cent of the plantations in central Europe, frequently decades before the normal maturity.

IV The value of the white pine depends on the volume of yield (III 2d) and the utility of the wood. The wood is characterized by its softness, lightness, its uniformity of annual rings, its small reaction to change in atmospheric moisture, and by the ease with which it is worked. As fuel and in the smaller timber classes it is of inferior value but it gains importance as large timber (with middle diameters ranging upwards of 30 cm. (11 3/4 inches).

V Forest Importance and Silvicultural Treatment of White Pine

1) Owing to the great dangers during its youth and during the pole stage the cultivation of white pine for itself is to be discouraged.

2) On the other hand the silvicultural and physiological qualities recommend its cultivation as a means to an end, its value for yield being less than for these other qualities. Its cultivation has been limited to a temporary mixture or it has been assigned a local place in the cultivation as a transient pure stand or as an outer-wood with long rotation. Both manners of application are especially indicated in the climatic optimum of white pine and on congenial slightly loamy and fresh soils, and poor soils with high precipitations; furthermore on sites heavily over grown with weeds or where otherwise injured, and especially on variegated sands, red conglomerates, slates, primitive rocks, waste areas, gravel slopes, etc. Within these limits the treatment for forest purposes is as follows:

As a Temporary Mixture:

a) Only such form of mixture of the white pine is indicated, that by removing the trees no open stands are left, thus, a mixture of single or small groups of trees.

b) As a tree that covers and improves the soil in a short time, it renders excellent service in an even-aged mixture with other trees, expecially in the districts where Scotch pine is injured by the snow.

c) It works very well in uneven-aged mixtures as an auxiliary species or filler to repair holes in the forest, also as a substitute, for the accommodation of clumps of young vegetation in the manner of a nurse tree.

d) Fast growth and frost resistance make the white pine very useful in even-aged and uneven-aged mixtures as a protection against frost injury, especially in plantations of Norway spruce upon the congenial boggy and fresh soils.

e) Fast growth and tolerance to shade make it useful for succeeding cultivation in broken stands, as an underplanting in openings in Scotch pine, less so in oak forests.

f) As shelter against the wind it is most unsuitable, owing to the uncertainty concerning its wind-firmness.

As a Temporary Pure Stand or as an Outer Wood of Long Duration:

g) The white pine gives excellent results principally through its litter-use in the extensive management of oak coppice with pasturage beneath, in slightly impoverished localities often covered with heather for height of one meter (39 inches). When the soil has been improved, the permanent tree species are planted in the shelter of white pine, and such uses of white pine give mostly good results.

VI 1) The use of strong, 3 to 4 year old plants raised in nurseries is generally advisable. The cheaper and more simple planting of seedlings is possible, though only exceptionally. The fast young growth allows, and the need of space for growing requires, a wide spacing of plants.

2) Cleaning must help the white pine to accomplish its purpose, without injuring the permanent tree-species; the brush must be kept down continuously so as to secure more space in the pure stand.

3) Natural reproduction of the white pine is easily secured by planting the trees along the border of the woods, or in protected places. But the specific application of the white pine in the manner mentioned above excludes this reproduction.

Address by Dr. Carl von Tubeuf of Munich.

The third lecturer, Professor Tubeuf of Munich, who had offered no paper referred to the earlier treatment of the question (Regensburg 1909). At that time very little attention had been paid to his warnings. Since then the troubles which people had with cultivation of white pine, have made them more careful. At the Strassburg session of the forest-association in 1883, the conviction was expressed, that increase in value of white pine was not to be expected. Borggreve had already called attention to its early death, at the age of 40-45 years; people thought this might be caused by the shoestring fungus (or honey fungus). Cronartium was not known at that time, but Borggreve's descriptions made us conclude that Cronartium was already prevalent. Plantations were made on a great scale in spite of these warnings. But today it is considered only a filler. Tubeuf gave a

comprehensive outline of the climatologic conditions in the home of Pinus strobus: fresh soils near the coast, warm summers with plenty of sunlight and great precipitations; dry sites are not suitable for this five-needled pine. It is neither a tree of the lime stone nor of the swamps. It thrives however also in districts with varying climatologic conditions and withstands warm winters, to which Picea excelsa is better adapted.

Among the enemies of Pinus strobus the shoestring fungus is especially dangerous in dry soils when deciduous woods have been changed to conifers. All the superficial roots carry masses of shoestring-fungus mycelium. Damage done by game is also very considerable (hedges should be made). Of insects the pine beetle and the bark-louse may be mentioned. The common fungus, pine leaf-cast of Scotch pine. (Lophodermium pinastri) is not to be feared, as compared to Hypoderma brachysporum the needle-browning of white pine. Cronartium ribicola was, however, the subject proper of the lecture.

Dr. Tubeuf gave the history of the disease, which had been observed in the Baltic region* as early as 1865; about this time it was established from specimens that there were two generations (of the rust fungus). The connection between white pine and the Ribes disease was not known until 1889. Later on it was noticed that the disease of Pinus cembra sibirica had been transmitted to Pinus strobus through Ribes. The great increase in the cultivation of Pinus strobus has favored the extensive distribution of the pest. The lecturer mentioned outstanding examples of the damage caused by this disease, and stated that it is worse in countries where Pinus strobus is at its best.

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*While the reporter uses the word Baltimore in this connection, it was evidently a misquotation. Dr. Tubeuf has published his address delivered before the German Forest Association at Frankfurt, August 24, 1927, in the Zeitschrift für Pflanzenkrankheiten und Pflanzenschutz under the title, "Das Schicksal der Strobe in Europa" (The Destiny of White Pine in Europe). In this address is found the following statement, to which the reporter probably referred: "Und auch die zweite Generation auf Ribes findet man in den Harbarien seit 1865 in Baltikum nach Dietrich....."

Dr. Tubeuf recommended experiments with Pinus peuce, resinosa, and Pinus montana arborea instead of with P. strobus, for plantations in woods that had become open. Older specimens of Strobus owe their life entirely to the circumstance that the blister rust was not generally distributed when they were seedlings. But cases of the disease are also known now in such plantations of old trees as at Trippstadt, Ansbach etc.

The nurserymen and the large plant-distributing firms are to be blamed to a great extent for the distribution of the disease. Enormous quantities of pines are sent out every year, even though it was known that young pines were infected with the rust. From the German nurseries the disease has been transmitted to the home of the white pine. The lecturer holds the opinion that sanitation without legal protection can not be secured. As the Cronartium

is a virulent parasite (not a weak one) energetic precautions forbidding its cultivation must be taken. Pinus monticola is also exposed to danger. Scratching or covering the cankers, and cultivation or care of the parasites of the fungus are not sufficiently effective means.

Having reported on his infection experiments, which may teach us about the first symptoms of the occurrence of the rust, the lecturer discussed the sanitary measures, each of which he considered separately. As such must be considered the legal prohibition against dealing in all non-immune species of 5-needled pines and Ribes, under the supervision of a Commission of Control; furthermore an order to destroy all diseased strobus and Ribes plantations. Pinus strobus may be replaced by P. peuce, and the red currant (Ribes rubrum) may replace R. nigrum. As modifying measures, are to be considered prohibition of the cultivation of strobus etc. in commercial nurseries and gardens, removal of all diseased trees in woods, parks etc. Only a radical sanitary proceeding gives us the hope that it may be possible to relieve Germany from this devastating disease. Experiments with immune species may be made, and such have been started with Pinus peuce raised from seed secured from Bulgaria.

The lecturer presented his experiences, and made additional remarks. One speaker asked the question, if it were really proper to apply to the legislative machinery for the sake of a merely subordinate matter such as a tree species. By means of strict measures on the part of the forest organizations, with the aid given by the forest-proprietor associations to the forest associations, it ought to be possible to prevent the cultivation of strobus. This would consequently check the trade in strobus. No conclusion was reached. The president suggested a further consideration of the question and the testing of Tubeuf's proposition.

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